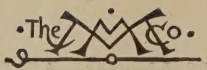
The Catholic
Theological Union
LIBRARY
Chicago, Ill.

SILENT READING



THE MACMILLAN COMPANY
NEW YORK · BOSTON · CHICAGO · DALLAS
ATLANTA · SAN FRANCISCO

MACMILLAN & CO., LIMITED
LONDON · BOMBAY · CALCUTTA
MELBOURNE

THE MACMILLAN CO. OF CANADA, LTD.
TORONTO

SILENT READING

WITH SPECIAL REFERENCE TO METHODS FOR DEVELOPING SPEED

A STUDY IN THE PSYCHOLOGY AND PEDAGOGY OF READING

The Catholic Theological Union LIBRARY Chicago, Ill.

BY

JOHN ANTHONY O'BRIEN, PH.D.

PROFESSOR IN THE COLUMBUS FOUNDATION
AT THE UNIVERSITY OF ILLINOIS

WITHDRAWN

EX LIBRIS PROVINCIAE PHIL STUDIO THEOL. S.S. CORDIS JESU.

373.4
O135

New York

THE MACMILLAN COMPANY

1921

All rights reserved

WARRIGHTIW

Copyright, 1921,
By THE MACMILLAN COMPANY.

Set up and electrotyped. Published March, 1921.

Norwood Press
J. S. Cushing Co. — Berwick & Smith Co.
Norwood, Mass., U.S.A.

To

BURDETTE ROSS BUCKINGHAM

In grateful acknowledgment
of my indebtedness to him

THIS BOOK IS DEDICATED

The Catholic Theological Union
LIBRARY
Chicago, IH.

23,211

PREFACE

THE processes and purposes involved in silent reading have lately been subjected to searching analysis. The former are revealed as both physiological and psychological, the latter as both complex and various. Each has its lessons for the guidance of the teacher; and each exalts the importance of reading as a school subject.

Reading processes on their psychological side are essentially associative — associative of impressions with meanings and of meanings with each other. In the latter sense they are frequently identified with study. Indeed, silent reading of the reflective type differs in no practical sense from study. The fact that in study we repeat and recapitulate adds but little of a qualitative nature to the reading act. Processes on the physiological side consist in large part of eye-movements. The number, length, groupings, and progressive or recessive character of these movements are at once symptoms and conditions of reading efficiency. Moreover, they take place according to patterns which are peculiar to each individual, being the product of original nature and of practice. So far as they depend on practice, they are capable of improvement; and this

improvement is a matter of habit fo tion. Since each eye-movement is definitely term d by a pause or point at which the eye rests and during which seeing takes place, the analysis of eye-movement becomes in fact the analysis of pauses. Better habits of eye-movement, therefore, consist in better habits of eye pausing.

The purposes of silent reading have been enumerated at some length by various writers. For example, we may read for appreciation, for entertainment, or for information; and each of these purposes may be combined to a varying degree of intensity with one or both of the others. Moreover, each is capable of subdivision. In reading for information we may seek to acquire as much as possible of what the author has written, or we may try merely to apprehend his main points, or again we may wish to find out what, if anything, he has to offer on a topic which we have in mind before we begin the reading. Moreover, with reference to these informational purposes, we may read for immediate use, or for use on a definite and early occasion; or we may read to make the material as permanent a possession as possible.

It is clear that in the teaching of reading the purposes for which people read must receive consideration. In particular, pupils should be placed in situations where certain purposes consciously or unconsciously become appropriate; and they should be led to adopt attitudes and modes of action with reference to these purposes. Thus the method by which reading is taught

will vary with the object in view. But no matter what the object may be, the material must be *understood*, or the process is not reading at all. The degree of comprehension, in the light of the reader's purpose, is rightly taken as a test of good reading.

It is not, however, the only test. No matter what the reading purpose may be at any given time, the effectiveness of the reading act is dependent not only on the degree of the reader's comprehension but also upon the readiness or speed with which the act takes place. Moreover, rate and comprehension of reading are related in such a way that on the average fast readers comprehend better than slow readers. This does not mean that a given individual comprehends better the faster he reads. It means that as between two individuals one of whom has a natural or habitual rate higher than that of the other, the faster reader will probably read more understandingly. It also means that if the same individual can raise his rate of habitual reading, he will probably improve his comprehension of what he reads.

There are reasons why this should be true. In the first place, since comprehension is an associative process, it will be facilitated, as association is always facilitated, by anything which brings the associated elements into closer sequence. Rapid reading brings into operation the law of contiguity by bringing the author's ideas into the reader's consciousness in immediate connection with each other. The child who reads haltingly under-

stands little because he receives the ideas in isolation. In the second place, the actual process of reading should be in the background of consciousness in order that attention may be concentrated on the thought. The rapid reader is the one who has so mastered the mechanics that this concentration of attention can take place.

Not only are the reasons plausible for a connection between comprehension and rate of reading, but the evidence on the question is conclusive. On numerous occasions data have been published. For example, in an article in the March, 1920, number of the *American Schoolmaster* a brief but clear-cut inquiry was made into the relation between rapid reading and understanding of the material read. A class of college students, reading a psychological article for one minute, varied in the number of words read from 174 to 520. Immediately after the reading, questions were asked on the first paragraph which, since it contained only 154 words, had been read by all the students. There was a tendency for the fast readers to answer more questions correctly. The strength of this tendency may be expressed by the fact that the person who ranked above the average in rate had five out of eight chances to rank above the average in comprehension.

Therefore, both because rate is an important factor in every type of reading and also because it tends to vary with comprehension, rate of reading is an important test of good reading. Indeed, one may plausibly

contend that a person's habitual rate of reading is the one best measure of his ability as a reader. Not only does it go with comprehension but it also strictly conditions the volume of reading. Everything we do is done in time. I have a certain time to devote to the morning paper. The extent of my comprehension of the news of the day depends to a large extent on the amount I can cover in the time at my disposal. In a large sense the amount which one can read measures the extent to which one is well informed. In school the pupil who can read rapidly reads much, and by that fact alone has a better understanding. In adult life praise is accorded to the "well-read" man. Comprehension, therefore, as it concerns competence in reading, is definitely related to the amount read; and the latter is in turn definitely related to the rate at which reading takes place.

The conditions which favor rapid reading are therefore of importance to school people. If eye-movement is a matter of habit, then the laws of habit formation apply. If eye-movement conditions rate of reading, then these laws may be invoked to improve not only rate of reading but also the entire reading process. The present volume is an attempt — and it seems to me an unusually successful one — to realize under classroom conditions some of the possibilities for improving rate of reading which have been suggested in the laboratory. A practicable method has been devised and put into operation with regular teachers and with-

out requiring more than the usual amount of class time. Indeed, the method is simplicity itself. Taking a cue from the so-called psychology of skill, and regarding the improvement of eye-movements as analogous to the improvement of hand movements in typewriting and telegraphy, the author has provided for intensive effort during short periods. The effort is specifically directed toward the most rapid reading which is consistent with the understanding of what is being read. The details of the method are the devices used to stimulate and maintain effort.

It is recorded that under the pressure of this effort the pupils broke to new high levels of reading rates. These levels were no doubt accompanied by integrations of short eye-movements into longer movements just as under stress Professor Book's typists integrated their movements and attained "higher order habits."

As a contribution to methods of teaching silent reading, this book will be regarded as significant. It does not pretend to exhaust the subject. The plan has rather been to "divide and conquer" — a maxim as valid in education as in war. The author has recognized the value of speed and has set up a way to attain it. Although he has also provided for a record of comprehension, he has done so chiefly in order to prevent its deterioration while speed was being developed. He gives evidence tending to show that in this he has succeeded. His method is so readily adaptable to conditions that it may be utilized in conjunction with

a complete method of teaching silent reading which takes account of the varying purposes for which reading is done. Reduced, for example, to a ten-minute practice period a day, it will leave time for the different kinds of reading which have been identified with study; and it should make all of these more productive.

B. R. Buckingham.

ACKNOWLEDGMENTS

THE present study is a coöperative investigation. It represents the work of many minds and many hands. The investigation has been conducted by the author, under the auspices of the Bureau of Educational Research at the University of Illinois. To the Bureau the writer acknowledges his indebtedness for assistance of many and varied kinds.

To the superintendents, principals, teachers, and pupils participating in this investigation, the author's gratitude is due. To their painstaking labors and careful execution of directions, much of the success of the experiment is attributable.

The author acknowledges with pleasure the courtesy of the College of Education of the University of Chicago for graciously permitting the use of the apparatus for photographing the eye-movements of readers. His thanks are likewise due to Dean W. S. Gray, of the University of Chicago, for valuable suggestions, and to Mr. G. T. Buswell, of the same institution, for his work in developing the photographic records.

For assistance in this research the author acknowledges his indebtedness to Professor B. R. Buckingham, Professor D. S. Hill, Professor W. W. Charters, Professor W. S. Monroe, then members of the College of Education of the University of Illinois. The author is also grateful to Professor I. M. Bentley, of the De-

partment of Psychology, and to Professor E. C. Cameron of the College of Education of the University of Illinois, for reading many chapters of the manuscript and for helpful suggestions and criticism.

To Professor W. W. Charters, formerly Dean of the College of Education of the University of Illinois, the author is indebted for his sympathetic interest and encouragement, and for a kindness of a nature quite apart from our academic relations. He wishes to acknowledge here also his gratitude to Professor G. M. Whipple, who first interested him in the experimental study of problems in educational psychology.

In a most especial manner is the author indebted to Professor B. R. Buckingham, Director of the Bureau of Educational Research, under whose immediate supervision this investigation has been conducted. Despite the pressure of multitudinous duties, Professor Buckingham's guidance and assistance have been constant and unfailing. Whatever of merit may be found in the present study is due in a large measure to his invaluable directions and guidance; the shortcomings represent merely the author's inability to profit fully by his guidance.

There are many others who have assisted the author in various ways. Their names, though too numerous to be mentioned here, are not too numerous to be retained in the grateful memory of the author.

J. A. O'B.

The University of Illinois
May 14, 1920

TABLE OF CONTENTS

CHAPTER		PAGE
I.	Introduction: Résumé of Previous Investigations	1
II.	The Problem	31
III.	Factors Influencing the Rate of Silent Reading	36
IV.	Type I. Training in Rapid Silent Reading	82
V.	Type II. Training to Decrease Vocalization	100
VI.	Type III. Training in Perception	126
VII.	Statement of Procedure	149
VIII.	Statement of Results	166
IX.	Interpretation of Results	195
X.	Photographic Record of Eye-Movements during Reading	232
XI.	Summary of Conclusions	270
XII.	Bibliography	275
XIII.	Appendix	281

SILENT READING

CHAPTER I

INTRODUCTION: RÉSUMÉ OF PREVIOUS INVESTIGATIONS

SINCE the invention of the art of printing by Johann Gutenberg about 1448, the reading of printed symbols has continued to grow in importance until to-day it constitutes the fundamental subject of the elementary school curriculum. More than one-fourth of the total time in our grade schools is now devoted to the teaching of reading, according to a recent investigation of time distribution (1).[1] Indeed, in the lower grades, little else but the mastery of the mechanics of reading is attempted. Dramatization, games, picture cards, blackboard exercises, charts, etc., find their essential *raison d'être* in the assistance they render to the child in his attempt to interpret the printed symbols. Probably 70 per cent of the time in the primary grades is devoted to exercises which have as their aim the inter-

[1] Numbers in parentheses refer to the corresponding numbers in the bibliography at the end of the book.

pretation of the written word. This is but natural, since reading constitutes the basic instrument which enables one to penetrate the mines of information not only in all the branches of the curriculum, but on every topic that has been, at some time or other, the object of human study and investigation. This information remains locked up securely within the printed letters of the alphabet, forever hidden from the illiterate, for it can be reached only through the medium of reading.

The method of teaching the mechanics of reading which held undisputed sway throughout the centuries was inherited from the ancients. Tracing with the stylus the various characters of their alphabet upon waxen tablets and on papyrus, the pedagogues of ancient Greece and Rome taught their pupils the names and phonic properties of each letter as the first and indispensable step in the process of learning to read. What could appear more logical than to postulate *a priori* that before a child could read or pronounce any word he must know the names and sounds of the constituent letters of the word? How could a whole word, consisting, as it does, of several letters, possibly be pronounced unless one had first mastered the pronunciation of each of the letters making up the total word? The fact that the word itself might be as simple and as clearly a unit of sound as the letter, seems never to have disturbed their serene acceptance of the above principle. Unchallenged and unques-

tioned the alphabetic method remained in almost universal use in the schools of the world until the last quarter of the nineteenth century. It remained for the new science of experimental psychology to demonstrate conclusively that the mode of procedure in the learning process which would appear to the adult as the logical order is not *de facto* always the mode of procedure which the mind of the child actually takes. In other words, there has been shown to be a psychological order of procedure which is totally distinct and different from the order of procedure deduced by the adult from the laws of formal logic (2).

Psychological Findings Modify Methods of Teaching the Mechanics of Reading

The studies of Cattell (3) at Leipzig in 1886 on the perceptual process resulted in producing strong evidence that, as a general rule, reading proceeds not by successive letters, but rather by word-, phrase-, and sentence-wholes. This conclusion was based upon the fact that the time required to perceive a whole word and, in some cases, whole phrases and short sentences, was no greater than the time required to perceive a single letter. Consciousness grasped whole words, phrases, and short sentences as units in the perceptual process. Goldscheider and Mueller's investigation (4) showing that an enlargement of the perceptual span resulted when meaningless geometrical lines were arranged in a meaningful geometrical figure, such as a

rectangle, likewise offered corroborative evidence. But the convincing confirmation of the above conclusion was presented when Erdmann and Dodge (5) after many tachistoscopical exposures, found that "words may be recognized when the individual letters are too small to be identified or when parts of the word are out of the range of clear vision."

Along with the wealth of corroborative data from similar experimental investigations, the above studies show that the assumption underlying the traditional alphabetical method, namely, that the reading process proceeds by successive letters, and not by word-, phrase-, and sentence-wholes, is without scientific foundation. Showing indirectly, therefore, that the word and the sentence methods more closely approximate the perceptual process, these findings are largely responsible for the discard of the time-honored alphabetical method — the result of tradition and crude empiricism — and the adoption of the word and sentence methods with consequent greater fruitfulness by the more progressive schools. These and similar studies, conducted under the strong stimulus of the new science of experimental psychology, have exercised a powerful influence upon the teaching of reading and are largely responsible for the fundamental and far-reaching changes that have been wrought in the technique of teaching the mechanics of reading during the last forty years. They have shown, furthermore, the necessity of submitting all the traditional methods

and conventional assumptions underlying the teaching of reading to critical experimental examination.

Movements of the Eyes during the Reading Process

Probably not less rich in promise of supplying valuable data for the development of types or methods of effective training in speed and comprehension in silent reading, in the stages subsequent to the mastery of the mechanics of reading than the above mentioned studies of the perceptual process, are the experimental investigations into the nature of the motor behavior of the eyes during the reading process. The origin of these investigations, like those concerned with the nature of the perceptual process, dates largely from the rise of the science of experimental psychology in 1870.

The history of the evolution of the mechanical apparatus necessary for the experimental study of eye-movements has been narrated by Huey (6), who himself became one of the most prominent investigators through devising and perfecting a mechanical apparatus which registered, with some degree of success, the movements of the eyes during the reading process. More recently, W. A. Schmidt (7) has sketched in briefer fashion the evolution of this equipment, supplementing Huey's account with the story of the developments down to 1917. The present investigation actually utilized the mechanical apparatus that was

finally evolved to photograph eye-movements during reading. Since the types of training for the development of efficiency in silent reading, which will be presented in this book, are based very largely upon the findings of the experimental investigations of the behavior of the eyes during reading, as well as upon the tachistoscopic studies of the perceptual process, it is thought that a brief outline of the chief stages of the development of this apparatus will help to supply the necessary background for any who may not be familiar with it.

Javal (8) of the University of Paris in 1879, employing direct observation by means of a mirror, in contrast to the after-image method of Volkmann and Lamansky, was the first to discover that the passage of the eyes across a line in reading is not a continuous movement, but is broken into a number of pauses and movements. In 1897 Erdmann and Dodge (5) in their experimentation at the University of Halle, besides the mirror method of observation, introduced to advantage the use of the telescope. Lamare (9), working in conjunction with Javal, fastened a microphone to the upper eyelid, thus enabling him to determine, in a general way, from the sounds, the number of fixations in reading a given line. Doctor Ahrens (10), at the University of Rostock in 1891, fastened a small ivory cup to the cornea of the eye and sought by means of a rod attached to the cup to have the eye movements recorded on a smoked drum. Though unsuccessful, the attempt was instrumental in suggesting to subsequent investi-

gators, a method which, if perfected, would yield rich results. A plaster of Paris cup was later substituted for the ivory cup by Professor Delabarre (11) of Harvard.

It remained for Huey, however, to perfect this general type of apparatus and to secure permanent records of eye-movements. After considerable experimentation in directly photographing the eyes, Dodge (13) finally succeeded in photographing "the movement of a bright vertical line as it was reflected from the cornea," thus giving a fairly reliable record of eye-movements undisturbed by the unnatural condition of a cup or other device pressing upon one of the eyes. Dearborn (14) introduced the use of double lenses, thus enabling him to obtain records of binocular reading. Judd (15) further improved the apparatus by employing a kinetoscope double camera, thus enabling records of eye-movements in both the horizontal and vertical planes to be secured. Various other refinements have been introduced by Freeman, C. T. Gray, and W. A. Schmidt while experimenting at the University of Chicago.

The evolution of this mechanical apparatus has rendered possible the carrying out of many investigations which have thrown considerable light on such points as the number of fixations per line, the duration of the fixations, the length of the eye-movements, and the relative time consumed in pauses and movements. Only those investigations will be referred to here which have in some way afforded clues for the develop-

ment of the types of training that will be described later, or which have presented problems upon which the present study may be expected to yield additional data. Since the total time spent in reading consists of the time consumed by the eye-movements, plus the time required by the fixations, an investigation seeking to economize the length of time required in reading will naturally be concerned in determining at which of the constituent time-consuming processes — movements or fixations — the economy can be most satisfactorily effected.

I. Interfixation Movements

Using the after-image method, Javal, the discoverer of the discontinuous movement of the eyes in reading, estimated the velocity of the interfixation movements to be so great as to prevent clear vision. On the basis of certain investigations, Erdmann and Dodge (5) calculated that only from one-thirteenth to one-twenty-fourth of the total time required for the eyes to cross a given line was consumed by the interfixation movements. Quite the reverse of the popular conception that had long prevailed that the total time spent in reading was consumed during the passage of the eyes across the printed line, Erdmann and Dodge found that almost the entire time was taken up by the pauses, or fixations of the eyes at various points in their journey across the line. The investigations made by Huey (12), Dodge and Kline, Dearborn, and more recently by C. T.

Gray and W. A. Schmidt, in measuring the rapidity of the interfixation movements, have conclusively confirmed the findings of Erdmann and Dodge. With such lightninglike velocity do the eyes move from fixation-point to fixation-point, that it is now generally agreed that fusion of stimuli occurs, so that, as far as purposes of clear perception are concerned, the eyes are practically "blind" during these movements.

The experimentation of Holt (16), leading him to the conclusion that the movements of the eyes produced "a momentary visual central anæsthesia," confirmed the findings of Dodge, which were again corroborated by Dearborn (17). From these findings, it is evident that the interfixation movements, consuming, as they do, such a small fraction of the total reading time, do not constitute the processes in the reading complex wherein any great economy of time can be effected. The question is, however, whether the development of a habit of increased rapidity of silent reading would measurably affect the speed of the movement of the eyes from fixation to fixation, as well as the return sweep from the end of one line to the beginning of the following, or whether, in spite of a considerable increase in speed of reading, the rate of these movements would remain unchanged. By measuring the rate of these movements before giving the training which resulted in the establishment of habits of greatly increased speed in silent reading, and then by measuring the rate of these movements subsequent

to the acquisition of this increased rapidity in reading, data have been secured which are of value in the formulation of at least a tentative answer to the above query.

II. The Fixation-Pauses

The processes of the reading complex which consume the bulk of the time, in fact from twelve-thirteenths to twenty-three-twenty-fourths of the total reading time, are the fixations or pauses which the eyes make at various points in their journey across the printed line. These pauses, the duration and number of which have been disclosed to us by experimentation, constitute the real "core" of the physiological process underlying the mental act of reading. Since the eyes while moving are incapable of clear vision, owing to the velocity with which they move from fixation to fixation and sweep back from the end of one line to the beginning of the next, it follows that whatever clear vision occurs must take place during the brief momentary fixation-pauses. Upon these fixation-pauses a large number of painstaking investigations requiring an elaborate equipment have been focused, with a view to determining chiefly their location, duration, and number per line.

The investigations of Dodge, of Huey, and especially of Dearborn have shown that fixations occur in every part of a word as well as between words, and are apparently subject to no definite law of occurrence. It

is the number and the duration of pauses that are of chief interest in a study that seeks to accelerate the reading rate. For the total reading time may be said to be the product of the number of pauses, multiplied by their average duration, plus, of course, the very slight fraction of the total time — one-thirteenth to one-twenty-fourth — consumed by the eye-movements.

(*a*) *Number of Fixation Pauses.* Investigations have revealed in this case, as elsewhere in educational psychology, the existence of great individual differences. Dearborn reports that his subjects in reading silently the same selections from a newspaper averaged from 3.0 to 7.1 pauses per line. In number of words perceived per fixation, the average ranged from 1.9 to 1.0 words. W. A. Schmidt reports a range of averages from 4.1 to 10.8 pauses per line in silent reading, and 6.1 to 11.5 pauses per line in oral reading. For Schmidt's adult silent readers, the averages ranged from 2.15 to 0.93 words per fixation, and in the case of oral reading the same subjects averaged from 1.52 to 0.87 words. It is obvious that the number of pauses per line is dependent upon the number of words perceived per fixation — the fewer the number of pauses the more extensive must be the perceptual span.

(*b*) *Duration of Fixation-Pause.* Of equal importance in determining the total amount of time consumed in reading, is the duration of the pauses. The number and the average duration of the pauses form, as it were, the multiplier and the multiplicand of approximately

the total reading time product, which latter cannot, of course, be computed, if either of the preceding are undetermined. Only comparatively recently has the experimental apparatus been evolved to secure accurate measurements of the duration of pauses. Huey reports that his subjects averaged approximately 185σ.[1] Dearborn, with more accurate apparatus, reports a range in averages for his five subjects from 160.8σ to 401.9σ. Schmidt (18) reports a range of averages for his silent readers from 214σ to 470σ, his elementary pupils averaging from 264σ to 438σ

Types of training to develop habits of speed which result in a considerable reduction of the total reading time obviously must either diminish the number of pauses or reduce their duration, or else effect a decrease in both. At the expense of which one of these processes is the economy of time to be secured?

From his elaborate experimental investigation of eye-movements, fixation-pauses, etc., Schmidt concludes "that a momentary silent reading at maximal rather than normal rate involves a shortening of the duration of the pauses rather than a lessening of their number. But this leaves unsolved the problem as to what would happen if the subjects were to engage in practice extending over a considerable period of time, gradually forming habits of reading at maximal rate." This he classes as one of the "interesting but as yet unsolved problems" in the psychology of reading. The present study,

[1] Sigma (σ) is $\frac{1}{1000}$ of a second.

through its formulation of types of training for the development of speed in silent reading and through its application of these methods of training to pupils in various grades of the elementary school for a period of two months, has sought to establish just such habits of reading at maximal rates. It is thought that the photographic records of the eye-movements of some of these pupils taken before and after the acquisition of this habit of rapid silent reading, will yield some interesting and valuable data upon this particular problem.

Comparison of Silent and Oral Reading

I. By Means of Photographic Records of Eye-Movements

The most important of the recent contributions to the experimental study of the reading process have come from investigators working at the University of Chicago. An elaborate experimental study of the motor behavior of the eyes during the reading process has been made by W. A. Schmidt (7). His comparison of the photographic records of oral and silent reading by adults, high school pupils, and elementary school pupils is significant and instructive. His records reveal the physiological basis of the superiority of silent over oral reading in point of both speed and comprehension. Thus, his group of 45 adult persons averaged 1.7 more pauses per line in oral than in silent reading, while the average dura-

tion per pause was 72.6σ greater in the former than in the latter. This made the average fixation time per line 1119.1σ longer for the same subjects when reading orally than when reading silently.

The smaller number of fixations per line and the shorter duration of the fixations may be said to constitute, in a general way, the chief physiological basis of the superior speed of silent over oral reading. The closest index to the physiological basis of the superior comprehension in silent reading may be said to be the smaller number of refixations per line. A refixation is a regression of the eyes to an anterior portion of the line, which portion has been already once fixated but which has evidently not been comprehended. The refixation appears necessary to complete the understanding of the line. The group of adults averaged 74 per cent more refixations per line in oral than in silent reading; the high school pupils 55 per cent more; and the elementary school pupils 62 per cent more. Schmidt reports that his subjects "read 57 per cent more material silently than orally."

On the strength of his investigation Schmidt draws the following significant conclusion:

"There is in evidence in connection with silent reading a very definite tendency towards positive correlation between the rate and comprehension, rapid readers representing a higher quality of comprehension than the slow. No such correlation is in evidence in the case of the oral reading. In fact, there are some indications that an increase in rate may

be inconsistent with good quality of comprehension. The difference between the two types of reading would undoubtedly have been more marked had the subjects been trained to distinguish between the two. As a matter of fact reading has until recently been taught so poorly that it is extremely hazardous to speak of standards for either type of reading as well as standard differences between the two types. Training in silent reading has been almost unthought of and whatever may have been accomplished in the case of oral reading during the earlier grades has not infrequently been undone because of indifferent practices in connection with the later grades."

C. T. Gray (19), in an investigation recently conducted at the University of Chicago, has contributed additional valuable data on the types of reading ability determined through standard tests and laboratory experiments. His findings likewise emphasize the superior efficiency of silent over oral reading. The methods employed by him in the experimental laboratory to increase the speed and comprehension of two individual subjects have largely furnished the clues for the formulation and development of types of training which have been adapted for classroom procedure under the ordinary conditions of the school. In the eighteenth yearbook, W. S. Gray (20) elaborates these and other factors tending to condition the efficiency of silent reading. Though the types of training to be presented in this book had been formulated before the appearance of the yearbook, it is believed that all of Gray's main suggestions

have been incorporated in the development of the types of training in the present study. Judd (21) has also greatly stimulated interest in the nature of the reading process by his recent monograph in which he interprets the meaning of the photographic records of eye-movements, fixation-pauses, etc., and points out their diagnostic value to teachers of reading. The present study has attempted to utilize many of his suggestions for increasing efficiency in silent reading.

II. By Means of Standard Tests

Significant as are the findings of the psychological investigation and the laboratory experiments in disclosing the functioning of the various constituent processes of the reading complex, showing, as they do, the physiological basis of the superior efficiency of silent over oral reading, it is chiefly the mass of investigations wherein the efficiency of school products has been measured by the simple standardized tests that have convinced and are still convincing practical school men and women of the superiority of silent over oral reading, both in point of speed and comprehension. The application of a variety of scientific standardized reading tests to pupils in the elementary school, high school, and college has resulted in the accumulation of voluminous data confirming the above conclusions of the experimental laboratory.

(*a*) *Comparison of Rates.* In 1913 Pintner (22) conducted an investigation with twenty-three pupils

in the fourth grade in which he found that the pupils reading silently averaged eight lines more per minute than when reading orally — a superiority of 40 per cent in point of speed. Oberholtzer's (23) investigation of the rate of silent and oral reading, as shown by testing 1800 elementary school pupils in grades three to eight, yielded superior averages for silent reading in all of the six grades examined. Starting in the third grade with an average superiority of 0.2 more words per second when reading silently than when reading orally, the superiority of silent reading in point of speed continued to manifest itself increasingly through all the grades, until, in the eighth grade, the pupils read approximately one complete word more per second silently than they did orally — the averages being 3.9 and 4.8 respectively.

The investigation of Meade (24) with 100 sixth grade pupils, and especially the extensive study reported by Judd covering all the grades in 44 different schools, prove the greater rapidity of silent over oral reading beyond all shadow of doubt. This conclusion, after all, is only what one would naturally be led to expect. For vocalization involving rather elaborate movements of the lips, tongue, vocal chords, and general throat mechanism is a much slower process than visualization. Consequently, in oral exhibition, the reader is obliged to retard the rate of visualization in order that the more tedious process of vocalization may keep pace with it. Synchronization of the vocal and visual

records of oral readers, as secured through an elaborate mechanical equipment in an investigation, the results of which are soon to be published by G. T. Buswell in his dissertation for the doctorate at the University of Chicago, offer corroboration of the above conclusion.

(*b*) *Comparison of Comprehension.* Not only is silent reading more rapid than oral reading but it is also superior in point of comprehension of the matter read. Though oral reading secures more time for the process of comprehension, yet the division of attention which oral exhibition necessitates, drawing part to the task of articulation and enunciation, and part to the understanding of the content, seems more than to counterbalance the first apparent advantage. The effort to enunciate correctly, to stress in accordance with the laws of the rhetorician, renders difficult that strong concentration of attention upon the content side which is the *sine qua non* of effective thought mastery, and which is more readily obtainable in simple visualization.

The results of testing by means of various forms of reproduction of the matter read serve to reënforce the above conclusion. Meade reports that all the sixth grade classes reproduced more effectively when they read silently than when they read orally. Pintner reports that a greater percentage of points were reproduced by his fourth grade pupils when they read silently. As a result of their investigation in 1916, Pintner and Gilliland (25) draw the following conclu-

sion: "the silent reading of the adult is quicker than the oral reading and at the same time the number of ideas remembered is slightly greater, certainly much greater per unit of time."

(*c*) *Correlation between Speed of Reading and Quality of Comprehension.* Besides demonstrating the greater efficiency of silent over oral reading in point of speed and comprehension a number of investigations have shown the existence of a positive correlation between rapidity of reading and quality of comprehension. As far back as 1897, Quantz's (26) study led him to conclude that the rapid readers average approximately 37 per cent superiority over slow readers in the quality of their work. He observed then, what later researches have confirmed, that the memory in the case of rapid readers seems to be more accurate, introducing in the reproduction of the matter read less extraneous matter than in the case of slower readers. As a result of his study reported in 1911, Hendricks (27) concluded: "in the percentage of thought reproduced the rapid readers excel, giving 91 per cent of the thought as compared with 76 per cent reproduced by slow readers." After an extensive study of 1831 pupils Judd (28) reports: "These figures serve to emphasize the fact that good readers are usually not slow and poor readers are usually not fast. It will be shown later, in detail, that rate is parallel in a majority of cases with general efficiency in reading. For the moment, it is enough to point out the chief reason why ability to read rapidly

is a fair measure of the mastery which the reader has of the printed page. The poor reader is one who is unable to pass readily from the printed symbol to the meaning. For the poor reader the mere mechanical processes are obstacles and he loses time in trying to perform the preliminary acts which are necessary before he can comprehend the passage. In the case of the good reader, on the other hand, the mechanics of the process are very fluent and rapid. The proficient reader has mastered the words and moves on without hesitation to the meaning." W. S. Gray (20) thus aptly epitomizes the experimental findings on this point: "The rapid reader is usually more efficient than the slow reader."

Silent Reading though Most Important Is Neglected by the School

Though investigations have shown the superior speed of silent reading and its greater efficiency as a basic instrument for the gathering of thought and ideas from the printed symbols, yet one finds that the schools not only teach reading as an oral exercise but stress that side to the almost complete exclusion and disregard of silent reading. There is no place in the curriculum in the overwhelming majority of our schools for silent reading. But may not this apparent anomaly find its justification on the grounds of the greater use to which oral reading is put? Frequency or extensiveness of use has come to be considered probably the strongest criterion determining not only the inclu-

sion or exclusion of the various parts of a subject but also the relative stress to be placed upon them. This is on the very reasonable ground which finds expression in the query: "Why teach something that is never, or at most, seldom to be used?" It is precisely here that the case for silent reading scores its strongest point. How often does the average person have occasion for oral exhibition? The writer has been present in several classes in which the students were asked to recall one instance of oral reading outside of the school in the past month. The instance was not forthcoming.

The plain facts are that the occasions requiring oral exhibition from either the adult or the pupil are notoriously few in life. Practically all the reading of the average person is done silently. He reads the newspaper, the magazine, the scientific journal, the novel, not for purposes of oral display, but for the sole purpose of gathering the thoughts and ideas contained therein. Consequently the training in oral reading which lasts throughout all the grades of the elementary school seldom, if ever, functions in actual life. But for the silent type of reading which a person is obliged to use almost daily during his school career as well as subsequently, the school has made no attempt to train. And this in spite of the fact that the school is supposed to train for the subsequent activities of actual life, and to have its own activities approximate, as closely as possible, the real conditions of life.

Stress on Oral Reading Detrimental to Effective Silent Reading

Failing to perceive the necessity of preparing the pupil for this important activity in which men and women in every vocation of life must engage, the school not only fails to train the pupil for this kind of work, but actually builds up fixed habits of word-pronunciation and articulation of a slow, plodding character which many investigators allege are almost ruinous to the formation of the opposite habits of rapid, effective, silent reading, of the meaningful type. While it is true that clear and distinct articulation and accurate pronunciation are necessary for correct speech and are acquirements of no doubtful value, for which the school must train, yet it is necessary to recognize that correct enunciation is not synonymous with reading, which consists essentially in the gathering of thought from the printed page. It is quite a distinct process, and should be taught as such, in a period set aside for the specific task of word-pronouncing, syllabication, articulation, and the explanation of the phonic properties of the various letters.

The distinction between these two types of work is fundamental and cannot be emphasized too strongly. The failure of many schools to recognize it has led them to the confusing assumption that in teaching articulation, the phonic properties of words, and accurate word-pronouncing they are teaching reading.

The result of this stress on the oral side has been to focus the attention largely upon the pronunciation, with a corresponding loss to the comprehension. Indeed, the number of pupils whose minds are found to be practically blank when stopped suddenly and asked to tell what they had just been reading aloud, has seldom failed to astonish the teachers who have occasionally employed this simple checking device. It shows how detrimental alike to speed and to effective comprehension is the exclusive teaching of the oral aspect of reading.

While there is every reason to believe that the teaching of reading has made many strides forward since the days of Horace Mann, yet it would seem that some points of similarity still persist, as is evident from the following description of the results of the teaching of reading as reported by him to the Massachusetts Board of Education in 1838. The passage is quoted by Judd, as follows:

"I have devoted especial pains to learn with some degree of numerical accuracy how far the reading, in our schools, is an exercise of the mind in thinking and feeling and how far it is a barren action of the organs of speech upon the atmosphere. My information is derived principally from the written statements of the school committees of the respective towns, — gentlemen who are certainly exempt from all temptation to disparage the schools they superintend. The result is, that more than eleven-twelfths of all the children in the reading classes in our schools do not understand the meaning of the words they read; that they do not master the sense

of the reading lesson, and that the ideas and feelings intended by the author to be conveyed to, and excited in, the reader's mind, still rest in the author's intention, never having yet reached the place of their destination. And by this is not meant that the scholars do not obtain such a full comprehension of the subject of the reading lessons, in its various relations and bearings, as a scientific or erudite reader would do, but that they do not acquire a reasonable and practical understanding of them. It would hardly seem that the combined efforts of all persons engaged could have accomplished more in defeating the true objects of reading."

Not very different in this respect from the days of Horace Mann are the present results of the teaching of reading according to the conclusion of Judd, reached after an exhaustive study of the present status of reading in our schools:

"Many a pupil leaves school equipped with the mechanical ability to read words, but utterly unacquainted with the possibility of interpretation. School reading has been a formal ceremony for the pupil. He has formed the habit of thinking that the words have been adequately dealt with when they have been sounded. The fault is with the school's selection of reading matter and with the school's emphasis on mere mechanical perfection in oral reading. . . . The present practice of continuing drills in the mechanics of reading through the elementary school undoubtedly retards pupils rather than helps them."

Thorndike (31) comes to a similar conclusion after an exhaustive analysis of errors made by children concerning the matter they had just read:

"In school practice it appears likely that exercises in silent reading to find the answers to given questions, or to give a summary of the matter read, or to list the questions which it answers should in large measure replace oral reading. The vice of the poor reader is to say the words to himself without actively making judgments concerning what they reveal. Reading aloud or listening to one reading aloud may leave this vice unaltered or even encouraged. Perhaps it is in their outside reading of stories and in their study of geography, history, and the like, that many children really learn to read."

Moreover, the habits of slow mechanical reading, resulting from a grossly misplaced emphasis and from defective methods of teaching reading, last not only during the pupil's school career, but tend to persist till his dying day. Undoubtedly many a reader need go no farther than his own case to find a concrete illustration of the following generalization made by Huey:

"Doubtless many of us dawdle along in our reading at a plodding pace which was set and hardened in the days of listless poring over uninteresting tasks or in imitation of the slow reading aloud which was so usually going on either with ourselves or with others in the school."

Exclusive Teaching of Oral Reading — An Anachronism

In view of the above findings, the question might well be raised: Why then does the school devote the entire reading period in practically all the grades to the teaching of oral exhibition, as though it were the sole instrument of value, to the complete exclusion and

absolute disregard of silent reading? In other words, why does the school devote itself almost exclusively, so far as the reading period is concerned, to the setting up of habits of word-pronouncing and the vocalization of the printed page, which habits are very seldom if ever used outside of the formal reading period of the school, and neglect almost entirely the formation of the habits of far greater value — habits of rapid, effective, silent reading, the type that is quick to assimilate the thought from the printed symbols, the kind that is called into function every day of the pupil's school career and during practically every day of his subsequent life?

The answer to the above question is twofold. First, the majority of the investigations reported above are of comparatively recent date. This is especially true of the mass of investigations measuring the efficiency of reading by means of the standardized tests. The bulk of them have occurred only within the past decade. The practical significance of the findings is only now beginning to filter through into the vast army of practical school men and women — superintendents, principals, and teachers. Educational practice must always lag somewhat behind educational theory, as well as behind the findings of scientific research. When the results of scientific studies become disseminated sufficiently broadcast throughout the ranks of practical school people, the schools, especially those directed by progressive educators, will not fail to modify their present

practice and to incorporate into their mode of procedure the new methods and the relative stress which spring directly from the certain findings of scientific research.

The second reason for the almost exclusive teaching of oral reading and the neglect of silent reading is the fact that, as yet, no systematic methods for the teaching of silent reading have been worked out. There are as yet no types of training, in rapid silent reading, which have been developed and adapted to the actual working conditions of the classroom. The experiments to train in effective silent reading thus far have been largely concerned with one or two, or at most a small group of subjects, and the experimenters have relied to a large extent upon the technical apparatus of the psychological laboratories, such as the tachistoscope, to produce the desired results. Needless to say, the general use of such apparatus by the schools, at the present time at least, is both impractical and impossible. Indeed, the bulk of the instruments, such as the tachistoscope, the fall chronometer, and the various kinds of perceptual apparatus, have been constructed for the use of but a single subject, and extensive modifications would be necessary before they would be suitable for group usage.

In sharp contrast to the paucity or rather complete lack of classroom methods for the teaching of silent reading, numerous methods and systems for the teaching of the mechanics of oral reading have been most carefully worked out. Occupying for centuries a domi-

nant place in the elementary curriculum, it has received the thought and study of many minds. It is but natural that teachers will continue to use the present methods of teaching reading until other methods have been devised which not only shift the emphasis to that phase of the teaching of reading where it will produce the best results, but which are suitable for classroom use as well.

Viewed in the light of its historical genesis, the teaching of reading as an oral subject has come down into the present curriculum as a heritage from the ancient days when oratory, speech, and vocal instructions were not only the most important but almost the only instruments for the dissemination of thought and knowledge. Before the invention of printing, manuscripts, involving as they did so much and such tedious labor, were necessarily extremely few in comparison with the products of the present day press, and could not constitute the important medium of instruction which books do at the present day. While printing has revolutionized the conditions for the spread of ideas and the general means of education, yet the school under the sway of custom and tradition has preserved almost intact the curriculum of reading of the centuries past, with its sole stress upon oral exhibition, in spite of the fact that the objective conditions of life for which that curriculum was constructed now no longer exist. The subject of reading, like all other branches of the curriculum, tends, with the lapse of

time, to become petrified — a fossil of ancient practices — unless it is subjected to constant revision, modification, and adaptation to meet the corresponding changes in the objective conditions of modern life. The need of a readjustment, of a substantial shift of emphasis in this portion of the school's curriculum, to meet the changed external conditions of the modern world is both obvious and urgently imperative.

Shift Emphasis from Oral to Silent Reading

This needed readjustment can be effected by shifting the emphasis from oral to silent reading — in other words, by teaching silent reading. This is the conclusion reached by practically every investigator in this field. As a result of their investigations of the comparative efficiency of the oral and silent reading of the pupils in the elementary schools, in the high school, and in the college, Pintner and Gilliland draw the following significant conclusion:

> "Thus it would appear that silent reading is undoubtedly the more economical besides being the method best adapted to the ordinary activities of life, since the vast majority of our reading is silent. This being the case, we are forced to raise the pedagogical question, and ask why it is that so much more attention is given to oral reading than to silent reading in our schools?"

Probably no one has brought out more strongly or convincingly the pressing need for a radical shift of emphasis from oral to silent reading than has Judd.

After pointing out the mass of evidence from the photographic records of eye-movements and from the application of standardized reading tests, which show the unmistakable superiority of silent reading, Judd concludes:

"Enough (evidence) has been brought together to make it certain that in the middle grades there is a change in relation between oral language and reading which ought to be recognized by a radical change in methods of instruction. Oral reading should give way to silent reading and phonic analysis should give place to word analysis. Meanings should be emphasized and not the mechanical pronunciation of words.

"Many schools have not recognized the demand for a new type of instruction in reading from the fourth grade on and as a result have seriously injured the development of pupils. . . . The oral methods which are legitimate in the lower grades become inappropriate with the growth in fluency and range of recognition. . . . It is a mistake to jeopardize the child's independent, fluent, silent reading in the fourth grade by insisting during this period on the usual oral exercises. . . . The conscientious teacher supplied with a reading book and a period in the program carries on the well-known reading farce in the vain hope that the effects of unsuccessful teaching will be overcome by a liberal application of the same methods that produced the difficulties.

"Teachers ought to recognize with clearness the fact that in the upper grades silent reading is the really useful type of reading. They ought to understand that pupils outgrow oral training just as infants outgrow creeping when they learn to stand up and walk."

The above quotation from Judd may be said to represent fairly well the consensus of opinion of all the investigators and careful students of this subject.

CHAPTER II

THE PROBLEM

EVEN after the need for the teaching of effective silent reading has come to be generally recognized by teachers, they will still be hampered and restrained by the lack of a satisfactory technique, the lack of suitable methods for the teaching of rapid silent reading. Up to the present writing, there has been practically no systematic attempt to utilize the wealth of data afforded by the experimental investigations and the laboratory researches into the nature and mode of functioning of the various constituent processes of the reading complex, for the formulation of methods of training in effective rapid silent reading which are adapted to a whole class under the ordinary conditions of the schoolroom. This appears to the writer to be the outstanding problem, of urgent, practical importance, in the entire field of the psychology and pedagogy of reading. Unless the findings of the psychological laboratory and of the experimental investigations can be adapted to the development of practical methods of classroom procedure, the teaching of reading will continue to be in the future, as it has been in the past,

the slow, mechanical, oral type, unbenefited and unimproved by all the discoveries of scientific research.

To construct, for the teacher in the classroom, types of training in effective rapid silent reading, based upon the findings of experimental science, constitutes the problem in this investigation. Efficiency in silent reading depends upon both speed and comprehension. While means have been taken to safeguard the comprehension, the chief stress has been placed upon methods of increasing the rapidity of silent reading. In an age in which the best thought is committed to writing, and in which the printed symbol has supplanted the spoken word as the chief instrumentality for the dissemination of knowledge, the ability to read with speed and yet with understanding is of fundamental importance.

Since the literature in practically every field is now so voluminous that none but the fastest can hope to cover any considerable portion of its extent, it may be safe to say that, other things being equal, a person's efficiency in his profession will be largely proportional to the rapidity with which he can gather the thought from the printed page. An increase of speed in silent reading will, therefore, not only effect an appreciable economy of time and effort in the work of education, but it will increase the efficiency of both the pupil and the adult. It will, moreover, satisfy a keenly felt human want. For there are probably few persons who have not, at some time or other, felt themselves aglow with

the insatiable longing to penetrate deeper into their chosen field of labor, to make themselves masters in their field by assimilating the written thought and knowledge of the masters who have gone before. A considerable increase in speed of reading is the one effective instrument which will aid them in the realization of their desire.

The writer feels that the problem is, therefore, not only of academic interest, but is one of real, intense, practical importance and functional value. If successful in the construction of types of training which will actually increase the speed of reading to a considerable extent, even doubling or tripling its rate, the writer feels that the study will have served as a useful instrument in bringing the results of over half a century of scientific experimentation to bear directly upon the actual teaching of reading, rendering the latter immensely more fruitful and effective for the children of America.

The investigation seeks first to determine the various factors conditioning the development of speed in silent reading, to ascertain the comparative influence of the different factors in accelerating the reading rate, and to combine the important factors into a formulation of successful types of training in silent reading. While the investigation seeks mainly to furnish a practical answer to the question, implicit in the minds of thousands, How can I read more rapidly and yet with understanding? there are a number of minor

problems upon which it is expected to yield additional data.

Some of the questions upon which this study furnishes information for the development of at least tentative answers are the following: How does an increase in the speed of reading affect the comprehension? In other words, Is the comprehension thereby decreased, unaffected, or increased? Do the individual differences in rate tend to decrease or to become more prominent as a result of training in silent reading? What grades show the greatest susceptibility to improvement in rate of silent reading? At what stages in the progress through the grades should speed of silent reading receive the greatest stress? Does speed of reading seem to be conditioned chiefly by a native neurological factor whose limits of possible variation or modification are rather definitely fixed? If so, may the rate at which the neurological factor functions in the eye movements or the visualization of the printed page be determined by a reaction-time test? Does the quality of comprehension tend to persist in spite of changed mental attitudes, assumed in reading for different purposes? Do the present norms for rate of silent reading for the various grades still possess validity after training has been given in rapid silent reading? What are tentative standards for rate for grades in which pupils have been trained in rapid silent reading?

Data will also be presented concerning some of the

problems previously mentioned, such as the effect of habits of increased speed upon the perceptual span, upon the duration and number of fixation-pauses per line, and upon the rate of the interfixation movements and the return sweeps — data which will be of interest chiefly to students of the technical psychology of reading. Some suggestions for the improvement of the Courtis Silent Reading tests, employed in this investigation, have also resulted from the study.

The succeeding chapters will accordingly treat of (1) the factors affecting the development of speed in silent reading, (2) their formulation into types of training, (3) the results of the application of such methods, (4) the interpretation of the results, (5) the effect upon the motor behavior of the eyes, and (6) the conclusions.

CHAPTER III

FACTORS INFLUENCING THE RATE OF SILENT READING

WHAT are the factors affecting the rate of silent reading? With the single exception of Quantz's experiment (26) during 1897 in the psychological laboratory at the University of Wisconsin, there has been no other investigation of an experimental character, to the writer's knowledge, which has made the answer to the above query the primary object of research. There have been, however, numerous investigations which have ascertained the rate of silent reading of various groups of pupils. These pupils have often displayed different levels of achievement, as well as different methods of procedure and different characteristics in their reading, so that deductions have occasionally been drawn as to the factors which conditioned the resultant rates of achievement. These have been made chiefly by the process of correlation, rather than by the rigorous isolation of a single factor and then, under controlled conditions, measuring its potency. The latter method, while most fruitful in the physical sciences, is not possible in the complex type of mental activity required in a single act of reading.

Correlations have been found sufficiently high, however, to indicate in a general way the influence of certain factors in accelerating or in retarding the reading rate. The factors which will be enumerated are the by-products, as it were, of numerous investigations of various phases of reading, conducted both in the psychological laboratory and in the schoolroom. It is thought that all the factors which investigations have indicated to be of appreciable consequence in conditioning the rate have been included in the subsequent enumeration. The present study thus endeavors to utilize all the data which previous investigations have afforded on this particular phase of reading. These factors have been incorporated into various types of training to increase the rate. By applying these types of training to hundreds of school children in grades three to eight inclusive, the influence of these factors in accelerating the rate will thus be experimentally tested.

The following is a list of factors which previous investigations and the general literature on the subject indicate to be of some importance in conditioning the rate of reading. Each factor will be considered separately.

1. *Practice in Rapid Silent Reading*

That practice in a certain line of activity is an important factor in conditioning the quantity and quality of the resultant product is a fact which probably no

one will deny. This principle of the influence of practice applies to the reading process as it does to other mental activities. Huey's (6) own case is an interesting illustration of the result achieved through a determination to increase his reading rate by persistent practice. He says:

"I have considerably increased my own speed in reading by waking up to the fact that my rate was unnecessarily slow, and then persistently reading as fast as possible with well concentrated attention, taking care to stop short of fatigue until the new pace was somewhat established. I thus reached a speed of a page per minute for such books as Ellis' 'The Criminal' of the Contemporary Science Series, maintaining this rate for a half hour or so at a time, and with very good comprehension of what was read, although after such reading a very hasty review of the leading points was the most satisfactory procedure. My earlier speed was not half so great." (6)

Peters (37) conducted an experiment in 1914–15 to determine the influence of speed drills on silent reading. The investigation was conducted in grades three to six inclusive. The speed drills lasted "ordinarily from five to ten minutes." The regular oral reading work was not discontinued, these drills being given in addition, without, however, giving a greater total period of time to the experimental group than that received by the control group. The experiment lasted seven months. Peters reports a "gain of 18.7 per cent in speed, but a trifling loss in quality as a result of the speed drills." The following is a summary of the re-

sults in speed attained by the "drill" and the "no-drill" groups.

TABLE I. SPEED IN READING

	NOV. 6	JAN. 20	APR. 20	JUNE 2
Drill Group	167.7	266.5	219.8	261.4
No-drill Group . . .	201.1	248.0	253.8	264.9

The experiment of Peters bears some points of similarity to that part of the present investigation which aims at determining the influence of Type I — Training in Rapid Silent Reading. (See Chapter IV.) This investigation differs very considerably from Peters' study, however, in that this type of training constitutes a method complete in itself, to which was devoted the entire reading period. The ordinary procedure in the reading period of conducting oral reading recitations, phonetic exercises, drills in word-pronouncing, etc., was entirely replaced by training in speed and comprehension in silent reading. In the experiment of Peters the regular oral reading work was continued as usual, with the addition of a speed drill lasting "ordinarily from five to ten minutes."

The length of time assigned for the drill in speed in Peters' experiment is thus seen to be quite indefinite. Classes securing the full ten minutes for this drill would thus receive twice as much time for practice in rapid reading as the classes using only five minutes. Such a considerable variation in the possible amount of time

to be used in speed drills, with apparently no record kept of the amount each class *actually used* would seem to render difficult and uncertain any comparison between the gains made by the different classes. Furthermore, the continuance of the regular work in oral reading, to which most of the period was devoted, along with the speed drills of five to ten minutes' duration, would seem to render the final result the tangled product of a rather complicated and mixed course of training.

C. T. Gray (19) reports the results of training a single fifth grade pupil in rapid silent reading. The practice period varied from 15 to 20 minutes a day and continued for twenty days. "Speed was the aim here, at the expense of comprehension, if necessary. Nevertheless comprehension was also checked up by oral reproduction. . . . The material for the training was carefully selected, so as not to be too difficult and yet to require considerable effort on the part of the reader." Concerning the results of the practice, as determined by the same test which was taken before and after the training, Gray says: "In every test there is a decided improvement in speed. In only two of the tests is there any decrease in comprehension, and in each case this loss is on the most difficult test of the series."

Unlike the comparatively small increase reported by Peters the gain here varied from 84 per cent to 217 per cent. While no conclusion can be drawn from the performance of a single pupil, the large gain reported struck the writer as deserving of note. It raised in his

mind the query, Would it be possible to secure a similar percentage of gain when dealing with a much larger group of subjects? The investigation of the influence of Type I — Training in Rapid Silent Reading — represents the endeavor to secure an answer to that question.

Oberholtzer (23) conducted an investigation with 1800 pupils in grades one to eight in the Tulsa public schools to determine the rates of reading. Among the conclusions he draws from this study are the following:

"The rate of reading in all the grades is relatively lower than it should be if the habit of reading had from the beginning been acquired through conscious effort to improve the rate."

"One room showed an increase of 50 per cent in the rate after two weeks' practice in rapid reading. These tests showed that oral expression and the power to grasp the content were equally improved."

In an unpublished Master's Thesis (33) at the University of Chicago, Miss Bowden thus reports the results of practice upon the reading of a number of adults: "The figures show that . . . the reading rate may be markedly increased by practice." She also reports the influence of a ten-minute exercise in rapid reading upon the rate of a seven-year old boy. The practice continued for 40 days; the child's rate was increased from 12 words per minute to 55 words per minute. Miss Bowden is of the opinion that similar exercises in rapid reading would prove beneficial in increas-

ing the rate of elementary-school children whose motor habits are not definitely set.

That practice in rapid silent reading is therefore a factor of prime importance in conditioning the rate, the above-mentioned investigations abundantly show. It is true that many of these studies dealt with but a very small number of subjects, while in others the securing of data on this particular point was but a secondary consideration. In fact, the investigation conducted by Peters seems to have been the only one involving a fairly large number of subjects, which had as its primary aim the discovery of the influence of speed drills upon the rate of reading.

These studies are, however, interesting and significant, at least in the writer's judgment, not so much for the bulk or weight of their findings taken by themselves as for the corroborative evidence of an experimental character which they lend to a theory which has intrinsically very strong *a priori* grounds of credibility. For, as will be pointed out at greater length in the exposition of this type of training in Chapter IV, practice has a very marked influence on other types of activity, and there appears to be no inherent reason why reading should prove to be the solitary exception. Of the three types of training developed in the present study, and of any other embryonic ones touched upon in the literature on this subject, this method is, in the writer's judgment, the most important one, and the one which is possessed of the strongest intrinsic grounds of

plausibility. It has accordingly been made the basic principle or factor upon which has been constructed a distinct type of teaching method. This type is called Training in Rapid Silent Reading.

2. *The Decrease of Vocalization in Silent Reading*

The attention of students who have endeavored to analyze the reading complex into its constituent processes has often been attracted by the concomitant movements of the lips, tongue, inner palate, pharynx, vocal cords, and the general mechanism of speech. The reader apparently not only visualizes or perceives the printed words, but says them to himself. This combination of motor and auditory elements constitutes the so-called "inner speech" of silent reading. A consideration of the origin of this habit, of the psychological rôle it plays in reading, and of the possibilities of eradicating it, is reserved for a subsequent chapter. The writer will present here merely the results of investigations which indicate that the habit of vocalization, involving movements of the lips, tongue, etc., is a factor influencing the rate of silent reading.

One of the earliest attempts to discover the influence of lip movement and of the general motor tendency to vocalize was made by Quantz (26) in 1897. Concerning the results of his study, Quantz concludes:

"This shows that the motor tendency (as manifested by lip movement) in any degree has an influence detrimental to rapidity of reading, and the stronger the tendency the

greater is the hindrance; the numbers representing the lip movement regularly decrease as reading rate increases, and *vice versa*. . . . The ten slowest readers show almost double the amount of lip movement that the ten most rapid do."

Quantz further sought to ascertain the relationship between lip movement and the rate of reading. His conclusion is: "The ratio of lip movement to total amount of reading" is inverse. The "extent of reading works directly against movement of lips" as evidenced by the fact that "not one of those whose reading is widest is a lip mover to any extent which can be observed."

C. T. Gray (19) reports the results upon the rate of silent reading of training given to decrease vocalization. The two subjects chosen displayed a pronounced habit of vocalizing. The training consisted in first pointing out the disadvantages of the possession of this habit in a marked degree. They were then requested to read in their natural manner, but without vocalizing. Gray writes:

"Comprehension was tested either with oral questions or with oral reproductions. That the practice was effective was shown by the fact that no vocalization was noted when the subjects took the final tests. Their instructor reported that at first there was considerable distraction caused by the attempts to eliminate the vocalization. There was, however, a gradual decrease in this distraction, and before the end of the practice period the reactions of the children seemed perfectly normal. The practice continued for twenty

days. The length of time for each day was from twenty to thirty minutes."

A summary of the results of the training as determined by having the two subjects take the same test before and after the practice period is presented in Table II.

TABLE II. RECORD OF TWO SUBJECTS BEFORE AND AFTER PRACTICE IN THE DECREASE OF VOCALIZATION

	Reading to Answer Questions			Reading to Reproduce the Substance of Contents		
	Selection	Rate	Comprehension	Selection	Rate	Comprehension
6th Grade Subject	A	Gain 177%	Loss 75%	B	Gain 160%	Loss 0.2%
				C	Gain 88%	Loss 100%
4th Grade Subject	D	Gain 60%	Loss 11%	D	Gain 39%	Gain 71%
	E	Loss 13%	Loss 11%			

Table II is to be read thus: On selection A, the sixth grade subject made a gain of 177 % in rate, but lost 75 % in comprehension as measured by the answering of questions on the matter read. In reading selection B to reproduce the substance of the contents, the sixth grade subject gained 160 % in rate, and lost 0.2 % in comprehension.

Gray thus summarizes the "positive" results of the above experiment:

1. "Training in reading without vocalization results in a marked decrease in this motor accompaniment of reading.

2. "Training of the type mentioned above results in an increase in rate. In considering these results for gain in rate, it should be remembered that the practice work was done at the normal rate."

The "negative" results may be summarized as follows:

1. "In five of the seven tests taken by the two subjects there is a loss in comprehension; in one of the tests no change is shown in the results for comprehension; and in one test there is a gain."

In the case of these two subjects the attempt to decrease vocalization interfered rather considerably with their comprehension. The conscious attempt at inhibition was apparently somewhat disturbing, drawing off part of the attention from the assimilation of the content to the manner of reading it. This disturbing element would seem to be no more than should be expected during the initial stages of the breaking down of an old habit and the substitution of a new one. The experiment lasted such a short period that it leaves undetermined the effect that would be produced by a longer period of practice, when the decrease in vocalization would have become habitual or automatic, and would in consequence have drawn no conscious attention from the comprehension of the content. Furthermore, the small number of subjects in this experiment — there were but two — renders it unsafe to draw any conclusion, save one of a most tentative character, concerning the effect this training would produce upon a large number of pupils.

That part of the present investigation which deals with Type II — Training to Decrease Vocalization — by extending this training to a much larger number of

pupils, and by allotting to it the entire reading period of thirty minutes daily for a period of two months, endeavors to throw some light on questions left unanswered by C. T. Gray's simple, but suggestive experiment. As will be pointed out in a subsequent chapter, the method worked out in Type II, while in principle similar to Gray's, differs from it in many important respects. It introduces a number of new details, devices in motivation, etc. Furthermore, it involves reading not at the ordinary leisurely rate, as in Gray's experiment, but at as fast a rate of speed as is consistent with effective comprehension.

Miss Abell (34) reports the results of an early investigation of the reading rates of 41 students at Wellesley. Concerning the relation of vocalization to rapidity in silent reading, Miss Abell draws the following conclusion :

"A characteristic correlate, in the case of our subjects, of slow reading, is the actual pronunciation or the vivid articulatory imagination of the words read. This device, which may assist in the comprehension of a strange word or of an obscure meaning, is certainly a hindrance when it becomes habitual. The discouragement of a child's tendency to accompany reading by articulation is an evident pedagogical requirement."

Dodge (35) reports that in his own silent reading, at the ordinary rate, the vocalization of practically every word occurs. In his most rapid reading of ordinary material, merely the beginnings of words are vocalized, while in his reading of very familiar matter, at top-

speed, only some words are pronounced. This further confirms the conclusion that a decrease in vocalization is correlated with an increase in speed.

Huey (6) reports a number of exceptionally fast readers. Among the number cited is the case of a mathematician who "read the whole of a standard novel of 320 pages in two and one-fourth hours." Commenting upon the nature of the reading process at such a rate, Huey says:

> "I am inclined to think that at any such speed the meanings suggested immediately by the visual forms suffice for all but the more important parts, and that these meanings are felt sufficiently, without inner utterance, to permit selection of what is more important, the more important places themselves having a fleeting inner utterance to vivify their meaning. . . . The inner speech in such cases must at any rate suffer a foreshortening and atrophy of articulatory details which reduce it to little more than a slight motor tallying as the meanings are felt or dwelt upon."

The results of the investigations above cited suffice to show that vocalization as manifested by lip movement, etc., in silent reading is undoubtedly a factor of some consequence in affecting the rate. Its effect, however, is to retard rather than to accelerate. Consequently, its elimination or at least its decrease would seem to be instrumental in increasing the rate. An attempt to accomplish this result has been made by devising Type II — Training to Decrease Vocalization. Though the lessening of inner speech is the

23,211

fundamental factor and the distinguishing characteristic of this method, there are also, as will be seen later, other factors of scarcely less importance which have been incorporated into this type of training.

3. *Training in Perception*

Photographic records of the eye-movements and pauses during reading have served to emphasize the fact that most of the total reading time is consumed by the pauses. In fact, the duration of the fixations being equal, the total reading time will then bear a direct relation to the number of fixations. The fewer the fixations, the shorter will be the reading time, the greater the number of fixations the longer the reading time required. Consequently, if a type of training can be devised which will effect a decrease in the number of fixations, the reading time will be correspondingly decreased. But the number of pauses per line is, generally speaking, conditioned by the width of the perceptual span. Training, therefore, which will enlarge the perceptual span will result in a reduction of the number of fixations per line, with a corresponding increase in the speed of reading.

Photographic records of the behavior of the eyes during reading have focused attention upon the fixation pauses, and have shown them to be the crucial points wherein any appreciable economy in the length of the reading time must be effected. A more [illegible] study of the nature of the fixation pauses, duration, the

EX LIBRIS PROVINCIÆ PII STUDIO THEOL. S.S. CORDIS JESU

extent of its visual reach, and the psychic processes occurring therein, is reserved for a subsequent chapter. It will suffice to indicate here that evidence of an experimental character shows that training in perception is a factor of importance in accelerating the rate in silent reading.

The experimental evidence showing the influence of this factor is the result of an investigation reported by C. T. Gray (19). Two fourth grade subjects, a boy and a girl, were given practice in quick perception by means of short-exposure exercises. Various kinds of material were exposed by a fall-tachistoscope for a fraction of a second. As the period of exposure was so brief that but a single fixation was possible, the material would have to be grasped in a single span of attention. The effort to perceive all the material exposed would thus tend to widen the span of attention, if the latter were at all susceptible to such improvement. Tables III and IV give a summary of the results achieved by each pupil as reported by Gray.

TABLE III. RECORD OF FOURTH GRADE BOY, BEFORE AND AFTER SHORT-EXPOSURE PRACTICE

	AVERAGE ON 2 WORDS	AVERAGE ON 3 WORDS	AVERAGE ON 4 WORDS	AVERAGE ON 5 WORDS	AVERAGE ON 6 WORDS	AVERAGE ON 7 WORDS
Before Practice	1.8	2.5	2.5	3.0	3.3	Omitted
After Practice	2.0	3.0	4.0	4.3	3.3	3.5

TABLE IV. RECORD OF FOURTH GRADE GIRL BEFORE AND AFTER SHORT-EXPOSURE PRACTICE

	AVERAGE ON 2 WORDS	AVERAGE ON 3 WORDS	AVERAGE ON 4 WORDS	AVERAGE ON 5 WORDS	AVERAGE ON 6 WORDS	AVERAGE ON 7 WORDS
Before Practice	1.3	1.0	1.6	1.5	2.2	2.0
After Practice	2.0	3.0	4.0	3.9	3.3	3.5

Table III shows a notable improvement in every case, except in the span for the six-word series, where the averages coincide. Table IV is even more striking. It shows a widening of the perceptual span in every series. While a fall-exposure apparatus was used in the practice exercises, a different instrument was employed in the original and final tests.

"This," says Gray, "eliminates to a large degree the element of adjustment to the apparatus and makes the marked increase in the perceptual span the more significant. The importance of a wide span of attention . . . makes this result all the more valuable. It seems that positive results can be obtained as early as the fourth year. In the light of these facts it may be repeated here that without doubt the type of training which is given in primary work by means of the flash cards is a very important element in the early training in reading. It is also clear that the foregoing results indicate the desirability of a better grading and control of such work. Incidentally the result makes it clear that training must come at the time in a child's development when it can produce results. Late training is often defective."

Gray's conclusion concerning the necessity of giving this training sufficiently early in the child's development, *i.e.* before the sixth grade, is based upon results secured from giving this type of training to two sixth grade pupils. These results indicated that "no striking change was made in the span of attention." Whipple (36) secured similar results with adults.

It is probable that a distinction has to be made here between the *absolute* span of perception, as determined by tachistoscopic exposures, and the *relative* span of perception which actually functions in reading. Though tachistoscopic exposures may show no widening of the absolute span of attention as a result of training in perception, there may nevertheless result the functioning of a wider span of attention *in reading* than was the case before the training. In other words, there results the more effective *use* of the perceptual span in reading, where it practically never covers the extent of printed matter, which tachistoscopic exposures show is possible for it.

Consequently, while training in perception may not markedly increase the absolute span of attention for pupils in the sixth grade and above, nor for adults, the conclusion that the relative span of attention which functions in the reading of such persons may not be enlarged as a result of this type of training cannot be drawn. That this widening of the perceptual span in reading is not only a *possible* result of such training, but that it is the result which *actually* occurred in the

case of Gray's sixth grade subject B. R., the writer thinks can be clearly demonstrated from Gray's own figures. This will be shown in Chapter VI — Training in Perception. It is sufficient to indicate here that training to enlarge the perceptual span has been shown to be no unimportant factor in accelerating the rate of silent reading. It has accordingly been made the basic principle upon which has been constructed the third type of training.

4. *The Character of Subject Matter*

Simple material will naturally be read more rapidly than difficult material. Under this head comes also familiarity with the subject matter. Thus, the ordinary reader would probably find a treatise on psychology rather slow reading, while a psychologist would read and assimilate it rapidly because of his greater familiarity with the subject matter and greater apperceptional capacity.

Dearborn found that by assigning to a mathematician, a teacher in a secondary school, and a psychologist, subject matter unrelated to their respective lines of study, marked difference in the reading rates resulted. Dearborn reports that a reader saved one-third of the total time required for the first reading upon perusing the same selection a second time. The results secured in the present investigation — results which will be presented in a subsequent chapter — prove conclusively that, other things being equal, familiarity

with the subject matter notably increases the speed of reading.

5. *Habits of Eye-Movement*

Records of the eye-movements of many readers as shown in the monographs of Dearborn, C. T. Gray, Schmidt, Huey, and Judd, indicate that as a general rule rapid efficient reading is characterized by rather uniform, rhythmical movements of the eyes in contrast with the irregular movements and frequent regressions of the stumbling, halting reader. Dearborn as quoted by W. S. Gray (38), says: "It is in the writer's belief clearly indicated by the above experiments that one of the essentials of natural and rapid reading is that the reader's eye should at once be able to acquire a regular and uniform motor habit of reaction for each line."

Huey, in agreement with the above observation of Dearborn, remarked in regard to the eye-movements of the 20 graduate students whom he tested: "The readers showed a rhythmic tendency. Each would fall into a reading pace that seemed most natural to him, and would then read page after page in almost exactly the same time. Quite usually the differences from page to page would not be over three or four seconds. . . . Habits of eye-movement are doubtless important factors in setting the pace."

It is doubtless true, however, that the character of the eye-movements is affected very considerably by other factors, such as the size of the visual span, the

simple or difficult character of the subject matter, the purpose for which it is read, and the ability to grasp the meaning quickly. Yet over and above all these factors it is probable that there is a habit of eye-movement of a fairly definite kind, which functions in the ordinary reading of the individual, and which tends to persist to some extent, even when the character of the subject matter and other factors are somewhat changed. Of two individuals possessing equal assimilative capacity, reading the same subject matter under similar conditions, the habit of regular rhythmical eye-movements would tip the scales in favor of its owner over the unfortunate individual who has never rendered an ocular motor reaction of this type habitual in his reading.

Dean Fordyce (39) in a paper read at the Convention of the National Education Association in 1917 seems to regard this as the chief causal factor in accounting for the differences in rate. "The difference in reading rate," he says, "is largely a matter of the rhythmical motor habits into which the eye is trained in the early attempts to read. If the eye falls into the habit of pausing on each word, the rate is slow and plodding; if into the habit of taking in the larger units of phrases and clauses, the rate is correspondingly rapid and the interpretation even easier. The trained eye grasps the words of a phrase or sentence in a single unitary act; similarly the perceptive power grasps the ideas in their combined form in the thought."

Dean Fordyce further relates the rather striking acceleration of his own reading rate by gradually replacing his defective ocular motor reactions with regular well-balanced eye-movements. He says:

"The writer discovered several years ago that his reading rate was very much below the norm. He sought for months a means of remedying the defect. Being convinced that his difficulty was largely a matter of the defect in motor-eye habits, he set about the ludicrous task of learning to read as if he were a first-grader. The first reader was adopted for the practice. A series of exercises consisting first of a column of two-word phrases was used the first month. After his eye had fallen into the habit of seizing such phrases as units, another column of three-word phrases and clauses was adopted for practice. Later a column of short sentences was used. Through ten minutes of judicious daily practice on these exercises, and on simple easily comprehended prose, the author in a single year doubled his speed in reading, and has been pleased to note a similar achievement among his students as a result of such practice. By such exercises the eye falls into new motor habits of a regular rhythmical nature, enabling the student to read in large rather than small units. The *perceptual* span increases with the *ocular* span."

In the exercises above described, however, there was training not only in rhythmical eye-movements, but also training to increase the perceptual span. The widening of the visual span would naturally cause the eye-movements to cover a greater extent of the printed line, thereby necessitating fewer movements per line and tending to inhibit the numerous regressive movements which are the usual concomitants of a slow,

halting reading pace. Thus the exercises with the column of two-word, and then three-word, phrases, etc., would seem to be training which would have as its immediate specific effect the enlarging of the perceptual span to grasp these phrases as a unit in a single fixation. That would be training solely in perception. The work with the first reader and similar easily comprehended prose, however, would appear to be largely training in the formation of rapid, regular, and rhythmical eye-movements. The rapid reading of such simple familiar material which can be grasped instantly, seems to be especially conducive to the setting up of regular rhythmical eye-movements. These can gradually be crystallized into a habit which functions in almost all the individual's reading because it has now become for him the natural manner of reading.

The entire increase in Fordyce's speed in reading could not therefore be attributed solely to the formation of a habit of regular rhythmical eye-movements. Apparently a considerable share of the increase must be credited to an enlargement of the perceptual span, or to a more effective use of it in reading. Some of it is also doubtless due to the setting up of "higher order" habits of eye-movements.

The case illustrates how closely and almost inseparately are intertwined these two processes of the reading complex — eye-movements and perceptual span. Thus the functioning of a wide perceptual span in reading insures fewer movements per line, thereby

affording an extent of area sufficient to permit the eye to fall into a certain regular sweep, or rhythm of movement, which is practically impossible where the eye must pause once or several times on practically every single word. In the case of the training described by Fordyce, the functioning of the wide perceptual span would appear to be largely the causal factor and the regular rhythmical motor reactions the resultant. There is such an intimate interrelation, however, that they probably interact upon one another. It is very probable — and the experiments of Fordyce, Huey, and others lend great weight to the assumption — that the training in the regular rhythmical movements of the eyes across the printed line tends to enlarge the perceptual span, or at least to utilize it more effectively by preventing less overlapping of the perceptual spans in reading. As Fordyce expresses it "the *perceptual* span increases with the *ocular* span."

This regular rhythmical character of the eye-movements is pointed out as a general characteristic of rapid, efficient reading. It is not always present, however, in such reading. As Dearborn observes, "rapidity of reading is not necessarily correlated with regularity of movement," there being some fairly rapid readers who do not seem to have acquired this habit of eye-movement. They would seem to be fairly rapid, however, not *because* of the absence of this habit but rather *in spite* of it. An examination of the photographic records of the eye-movements published by

C. T. Gray, Dearborn, Huey, and Judd, and of those taken in the present investigation, shows clearly that one of the important characteristics distinguishing the rapid efficient reader from the slow plodding or stumbling one is the presence of a certain regular rhythmical character of the eye-movements. This rhythm is shown on the photographic records by a fair uniformity in the number of pauses, which are usually an appreciable distance apart, and by a somewhat "uniform method of time distribution" in the pauses. The hypothesis advanced by Dearborn (17) in explanation of this regular rhythmical character of the eye-movements in fast reading is that "the rapid reader distributes his attention more readily at the initial fixation of the line, and is enabled on this account to fall more readily into a uniform habit of movement." Whatever explanation of the fact is finally accepted, there can be no doubt that the bulk of existing experimental evidence points to the habit of regular rhythmical eye-movements as no insignificant factor in affecting the rate in silent reading. W. S. Gray (20) thus aptly epitomizes the evidence on this point: "Regular rhythmical movements of the eyes are prerequisite to rapid silent reading."

6. *Purpose for Which the Subject Matter Is Read*

The rate of reading is conditioned very largely by the purpose or object for which one reads. Reading simply to "get the gist" of the story or the selection induces

a mental attitude radically different from the attitude assumed when one reads for the purpose of answering detailed questions on the matter. The whole mental "set," the entire mode of attack, the degree of concentration, the amount of reflective thought and logical association, all of which influence the rate, will depend largely upon the end for which the reading is done.

Whipple and Curtis (40), in their investigation of skimming, found that a considerable "slowing down" resulted when the subjects knew that they would be required to reproduce. Besides ascertaining the differences in rate for both oral and silent reading when the reading was done for different purposes, C. T. Gray (19) took photographs of the eye-movements for the several different resultant types of reading. In the first type, the reading was simply for the purpose of securing "an intelligent understanding of the material. Three other types of records were taken. One of these was of reading which was followed by the answering of questions on prose; another was a passage of poetry, with the answering of questions; and a third was the reading of prose for reproduction. . . . These results (summarized below) indicate clearly that the reader does differentiate between different types of reading and evidently approaches different reading problems with a different mental 'set.' The results here reported are typical of all the subjects. It is also interesting to know that the length of the pauses does not vary in any large degree, while the number of pauses varies greatly."

TABLE V. EYE-MOVEMENT RECORD OF ONE SUBJECT SHOWING VARIATIONS ACCORDING TO PURPOSE FOR WHICH THE MATTER WAS READ.

	No. of Pauses per Line				Average Length of Pauses			
	Prose (Simply to Understand)	Prose (Answering Questions)	Poetry (Answering Questions)	Prose (Reproduction)	Prose (Simply to Understand)	Prose (Answering Questions)	Poetry (Answering Questions)	Prose (Reproduction)
Average	8.1	9.6	11.0	8.7	13.3	13.9	14.0	14.6

Table V is to be read thus: The average number of fixation-pauses per line in reading prose (simply to understand) is 8.1, in reading prose (to answer questions), 9.6, etc. The average length of the fixation-pause in reading prose (simply to understand) is 13.3 fiftieths of a second, etc.

TABLE VI. VARIATION IN NUMBER OF REGRESSIVE MOVEMENTS ACCORDING TO PURPOSE FOR WHICH THE MATTER WAS READ

	Prose (Simply to Understand)	Prose (Answering Questions)	Poetry (Answering Questions)	Poetry (Reproduction)
Average per line . .	1.8	2.4	3.3	1.8

Table VI is to be read thus: The average number of regressive movements per line in reading prose (simply to understand) is 1.8, in reading prose (to answer questions) it is 2.4, etc.

The figures in the above table tell the inside story of the differences in rate resulting from the different ends for which the passage was read. They show that the physiological processes are perceptibly different in each type of reading. There is a variation in the number of fixation-pauses, in the average duration of the pauses, as well as in the number of regressive movements.

These are the physiological correlates which reflect the differences in the conscious functioning in the changed mental "sets" or attitudes.

Besides the various aims in reading which have already been mentioned, there are numerous others which shade off gradually from one another. The following are illustrations of purposes for which a selection may be read, each of which would affect the reading rate in an appreciably different manner:

1. Simply to understand a passage, to "get the gist" of it.
2. To find a few specific facts.
3. To determine the logical consistency of a line of argumentation.
4. To appreciate the author's diction and general rhetorical constructions.
5. To criticize the thought or language of the selection.
6. To remember so as to retell to others.
7. To be able to follow directions of procedure.
8. To select only the main points.

These are but a few of the numerous purposes for which one actually reads at various times. They could be drawn out at greater length. This list, however, will suffice to illustrate the different attitudes assumed in reading, with consequent differences in both rate and quality of comprehension. That reading in the grades for one or two simple purposes does not develop the ability to read effectively for other ends is evident from

the results reported in 1917 by W. S. Gray (41) in the Survey of the St. Louis Schools:

"The facts presented above point to the conclusion that the various phases of silent reading ability do not always develop in the same proportion. Each phase needs special attention, and the teacher must plan instruction so that pupils receive effective training in all phases of silent reading ability. This includes not only ability to reproduce and ability to answer questions, but in addition, ability to select pivotal ideas, ability to organize, ability to determine the relative importance of facts, ability to associate new ideas with one's store of knowledge, etc. To the extent that a teacher gives specialized training along one or two of these lines, just to that extent will her pupils be more likely to fail in a situation which calls for silent reading ability of a broad character."

The character of the purpose for which the reading is done must accordingly be ranked among the factors of primary importance in conditioning not only the quality of comprehension, but also the rate of reading.

7. *Concentration of Attention*

Much of the time consumed in apparent reading is, in reality, lost through unconscious wanderings of the attention and fruitless daydreaming. The eyes often remain fixed upon the page while the mind is visiting distant climes and is busy "building castles in Spain." How much of the time seemingly spent in the reading of a book is actually frittered away in listless poring and idle woolgathering, especially if the subject matter is

rather heavy and somewhat uninteresting, is difficult to determine; but that it is considerable, the experience of most readers leaves no room for doubt. The introspection of a number of graduate students in education and psychology and two university professors, composing a seminar group at which this study was first discussed, strongly confirmed the writer's own conviction that this was one of the strategic places in the reading process wherein could be effected a very considerable improvement in both rate of reading and quality of comprehension. If this tendency of the mind to wander exists even in the case of adults, it must be much stronger in the case of children whose imaginations are usually very strong and active, but whose powers of concentration are much less developed.

Quantz's study, showing that the rapid readers not only averaged approximately 37 per cent superiority in the quality of their work, but also introduced less extraneous matter in their reproduction, offers corroborative experimental evidence of the above conclusion. Concerning the rapid type of reader, Quantz (26) says: "He introduces only two-thirds as many thoughts not found in the original selection." This fact doubtless finds its explanation in the greater concentration of attention necessitated by rapid reading, and the consequent avoidance of daydreaming and woolgathering which is undoubtedly the prolific source of the extraneous material found in the reproduction of a selection.

Concentration of attention may be promoted by various means. Chief among these is the judicious selection of interesting material which makes a strong appeal to the mind of the child. The matter must grip the pupil's attention, especially in the lower grades, instead of requiring his volatile, fluctuating attention to try to grip it. Much of the slow listless reading observable in many schools is largely traceable to the unsuitable character of the subject matter, which is not only not closely related to the child's immediate interests, but is also not infrequently beyond the pale of his actual experience. The consequence is that the concepts and imagery are lacking in vitality; the reading is verbal and hopelessly mechanical — "a sounding brass and a tinkling cymbal."

Besides the selection of subject matter that touches off the springs of the child's immediate interests, there are other devices chiefly in the line of motivation which assist in overcoming *die Wanderlust* of the youthful imagination and enlist the prompt and vigorous concentration of the mind. The pressure of a time control, the individual graph, and the class chart, which will be described later, are effective in accelerating the reading rate chiefly through their immediate effect in enlisting the strong concentration of the attention. The continued concentration of the youthful reader is scarcely susceptible to direct coercion; it must be effected largely by indirect means, such as those above described.

The significance of strong concentration of attention in increasing the speed of silent reading seems to have been too little recognized in the past. Some of the means utilized in the present investigation owe their incorporation into the types of training mainly to their immediate influence in enlisting the active attention of the reader. For even with the other factors present, and a fair degree of concentration lacking, the reading will be necessarily inferior in both quality and rate. In the present study, then, this factor is strongly stressed.

8. *Ability to Grasp the Meaning of Contents*

Since reading is in the last analysis a mental process, namely, the assimilation of the thought from the printed page, it is clear that the perception of the printed symbols is affected to some degree by the speed with which those symbols can be understood. Consequently in the reading of heavy difficult material, the part of the reading process which demands the bulk of the time and effort is probably not the operation of "getting the material to the brain, but of assimilating it after it is there." The necessity of making the proper logical associations, of examining the validity of the thought in the light of the principles already acquired, involves reasoning and studying of rather a high character. Such a process, which would seem to be more appropriately termed "studying" than simple "reading," naturally demands additional time.

But in the case of reading of the ordinary type of easily comprehended material, rather than in the "studying" process above described, the assimilation of the matter seems to occur as soon as the printed symbols are perceived. There appears to be no appreciable retardation of the rate due to the demands of comprehension. The reverse of this process would seem to be true at least in the majority of cases. The rate of comprehension is slowed up, waiting upon the tardier process of visualization, just as the latter is itself impeded in the case of oral reading by the more cumbersome process of vocalization. The introspection of many workers in this field, such as Huey, Fordyce, and of a number of persons interested in the present study, showed that their rate of reading was slow, not because they could not assimilate the matter rapidly, but because their perception of it was proceeding at a slow plodding pace.

Their subsequent determination to increase their reading rate resulted in quicker perception without impairment of the comprehension. These instances, which are typical of hundreds of similar cases, would seem to indicate that the reading rate at least in regard to the ordinary type of material is conditioned by rate of perception as well as by rate of assimilation. Most readers, in other words, proceed at a pace that is well within the limits of their *possible* rate of assimilation, which is seldom given the opportunity of functioning at as rapid a rate as is really possible for it.

Ruediger (42), however, apparently considers the assimilative factor the determining or "essential" one. As a result of some experimentation he concludes: "After having eliminated the physiological qualities pertaining to the mechanism of vision we saw that neither visual acuity, retinal sensitivity, nor the horizontal extent of acute vision had any significant correlation with reading rate. The essential factors that determine reading must be looked upon as central rather than peripheral."

This conclusion is undoubtedly true in regard to the rate at which difficult material can be intelligently read, and possibly it is true in regard to the upper limit of speed at which more easily comprehended material can be perused. In other words an individual's speed of reading can never actually exceed the rate at which it is assimilated. Otherwise it would be simple visualization, not reading in the intelligent sense. But are there many individuals who have attained a rate of reading which is the upper limit at which the process of assimilation can occur? The bulk of available evidence demands a strong negative answer. On the contrary it is probable that there are extremely few who have reached the upper limit in their rate of reading, *i.e.* the highest rate of reading at which the matter can be comprehended. There has been so much dead-level plodding, and so little recognition of the possibility of increasing the rate, and so few systematic attempts to do so, that it is safe to say that the rate at which most individuals

read can be considerably increased by the proper type of training without decreasing the comprehension of the matter read. The results of previous studies as well as those to be presented in the present investigation, showing marked improvement in rate of reading with no impairment of comprehension, constitute the basis for the above statement.

While admitting that the correlation that has been found to exist between the number of pauses and the reading rate does not apparently square with his conclusion as to the determining rôle played by the assimilative factor, Ruediger maintains that the number of printed symbols perceived during a fixation may be attributed to the central factor of comprehension just as well as to effective perception. But the fact that simple exercises, such as those which Dean Fordyce describes with a first grade reader and with columns of two-word and three-word phrases, and such as have been worked out in the present study, have notably increased the speed, not infrequently doubling it, proves conclusively that there are many factors besides the ability to assimilate which condition the rate of reading.

Such simple exercises cannot presumably have doubled the ability to comprehend, but they have increased the size of the visual span functioning in reading and have improved the character of the habits of eye-movements and other peripheral factors, thus producing a marked increase in rate of

reading. This conclusion is further corroborated by the results of Quantz's investigation of the relation of visual perception to rate of reading. After pointing out the marked correlation existing between these, Quantz draws the following conclusion: "This shows that mere quickness of perception with its large physiological element is an important factor in deciding one's rate of reading." Consequently, while the ability to assimilate is not unimportant, there are other factors, peripheral in character, whose influence in conditioning the rate of reading is of unquestionable significance.

9. *Recognition of the Value of the Habit of Rapid Silent Reading*

Probably the chief reason why comparatively few readers have acquired the habit of rapid silent reading is because of the general failure to recognize the possibility of greatly increasing one's rate, and consciously to advert to the value of such a habit. The discovery of the possibility of appreciably accelerating the rate is the result of investigations of comparatively recent date. This knowledge is only beginning to filter through into educational practice and to reach the popular mind. The recognition of the possibility of establishing immeasurably more effective and economical habits of rapid silent reading, and the appreciation of their value, are the first and necessary steps in their acquisition. Once these facts have been clearly perceived, the effort necessary to substitute "higher

order" habits of reading for slow dawdling ones will be readily forthcoming.

Accordingly, in the present investigation considerable care was taken to point out, not only to the teacher the possibility and the value of establishing such habits, but also to get this lodged clearly in he minds of the pupils. Unless they perceive the value of such habits, and are made to feel the need of acquiring them, the work is apt to be mechanical and lacking that earnestness which is the *sine qua non* of effective habit formation, and, in fact, of all successful work. On the other hand, if the value of such habits is perceived and the need felt, the successful outcome is already half assured. For from such an attitude there springs concentration of mind, enthusiasm, and sustained interest. Consequently this must be considered no unimportant factor in the acquirement of habits of rapid silent reading.

10. *The Will to Read Rapidly*

Closely related to the preceding factor, and growing logically out of it, is the will or determination to read rapidly. The writer believes it important enough, however, to deserve separate enumeration. The general literature on the subject of reading records several instances of persons suddenly awakening to the realization that their rate was unnecessarily slow. Accordingly they resolved rather simply and naturally to bring it up to a higher level. Marked success was

achieved. Thus Huey (6) owed the doubling of his rate largely to his simple determination to "speed up." The results of this study and the observations of teachers show that as a general rule those pupils who really displayed a determination to improve their rate did so to a notable degree. The pupils who secured the slightest increases were largely those who failed to "warm up" to the experiment and who were lacking in the strong determination to succeed. Indifference to improvement in their habits of reading on the part of individuals may be justly expected to produce indifferent results. The observations of the teachers in this experiment offer sufficient corroboration of this conclusion.

When first reading Huey's "Psychology and Pedagogy of Reading" the writer became convinced of the fundamental importance of this factor. The writer's rate in reading Huey at that time was about 35 pages per hour. Realizing that it was unnecessarily slow, he determined to bring it up to a higher level, and before finishing Huey, succeeded in reaching a speed of 50 pages per hour without any noticeable impairment of comprehension. It is thought that the incident is but typical of an improvement which can be effected by practically every reader who becomes determined to bring it about. Much of the ordinary reading is of the lackadaisical, dead-level, plodding type broken by many gaps of attention and much unconscious day-dreaming. A sudden determination to "speed up"

effects a change in the whole mental attitude; it shoots the attention rapidly over the subject matter, and replaces listlessness with spirit and dynamic energy. In fact, the statement can probably be made — and the results of the present investigation largely bear it out — that practically every reader who strongly wills to increase his rate, can actually do so — provided, of course, he employs some suitable means. The cases of Huey, of a number of graduate students, of Fordyce, the last of whom also employed supplementary exercises, are so many instances in point.

While the powerful influence exerted by a strong determination in accelerating the reading rate is perhaps rather obvious, the writer believes that this factor has not been sufficiently stressed, at least explicitly, in most of the literature on the subject. It cannot always be presumed to be present in the pupils. It must be aroused and enlisted in the enterprise. Otherwise, the undertaking in spite of endless technique and elaborately worked-out methods is foredoomed to failure.

11. *The Pressure of a Time Control*

This is a factor which the present investigation found to be of value in stimulating and maintaining a high rate of speed. When the pupil realizes that there is no check upon his performance, no means of determining his rate, there is the tendency for daydreaming and unconscious wanderings of the attention to occur. Not

that these disturbing elements are willfully invited, but the mental attitude is such as to offer no strong barrier to their entrance. The consciousness that a clock or watch is accurately measuring the pupil's rate of reading induces a mental "set," which focuses the attention directly upon the task at hand, and which is incompatible both with lackadaisical poring and leisurely dawdling.

In other words the pressure of a time check serves to "key up" the mind to a superior level of attention, which enables it to devote its whole conscious energy to the gathering of the thought from the printed page and saves it from the necessity of struggling against irrelevant ideas which tend to draw the attention away from the context. This is a device which, as will be pointed out later, is applicable to the three types of training which have been devised to accelerate the reading rate. An ordinary clock will suffice, though a stop watch is more convenient. In any type of training where speed is one of the qualities aimed at, it would seem that this factor cannot well be omitted.

12. *Individual Graph*

An effective presentation of the story told by the clock in measuring the pupil's speed may be secured by drawing the result on a chart. The single line ascending or descending tells the pupil the story of his success or failure. It is simple, impressive, and comprehended at a glance. There is no need for the comparing

of arithmetical figures. The direction or slant of the line tells the whole story. The ascent of the line becomes a source of joy; its decline a source of grief. The latter tells, moreover, in a convincing manner the necessity for greater effort on the next occasion. The zest of a game, the spirit of a combat is aroused. The pupil becomes determined to "make that line go up." As will be indicated later on, in the exposition of the effectiveness of the various devices employed in the present investigation, the individual graph made one of the strongest appeals to the pupils and proved one of the most effective instruments in stimulating their speed in reading.

13. *The Class Chart*

This served as a supplement to the individual graph. It consisted essentially in portraying the average or median of the class. Besides this the highest and lowest individual record for each day was traced on each chart. This showed the amount of variation and the room for possible improvement open for many members of the class. It had a stimulating effect upon the slowest members of the class, causing each one of them to strive not to be the last, which meant representation at the bottom of the class chart for that day. A similar effect was produced upon the faster ones, causing each one of them to strive for the honor of achieving the best record with the consequent representation at the top of the chart for that day.

The class chart did not admit, however, of the possibilities of the extensive comparison between individual members of the class which were afforded by the individual graph. The consequence was that it did not secure the rather intense motivation effected by the latter. It enabled comparisons to be made, however, between the different classes in the schools. The character of the motive which it engendered differed from that prompted by the individual graph. It fostered interest and loyalty to the *class as a whole.* It created the desire to see the class as a whole excel, instead of centering the attention solely upon the individual's own performance It was a type of motivation worth developing. It served, furthermore, to hold the interest of the class as a unit in the progress of the experiment.

To secure the best effect the class chart should be large and should be placed conspicuously in the classroom where pupils can easily see it. They should also be encouraged to look at the chart of the other grade or grades, in order to see where their class stands in comparison.

In this study most of the class charts were kept by the teacher, who computed the class average or median. She also ascertained the highest and lowest individual rates each day and recorded them on the class chart. In the upper grades the keeping of the class chart may be assigned to one of the more capable pupils if the teacher so desires. It entails but a minimum of

labor and exercises a stimulating influence in promoting a commendable *esprit de corps* which in turn helps to maintain the continued interest of the class as a unit in the progress of the experiment. It is one of those factors which strengthen directly the morale of the group as a whole and exercise a reflex reënforcing influence upon the individual attitude as well.

14. *Reaction Time*

The perceptual span, the fixation-pause, the interfixation movement, the return sweep, have all a large physiological core. The general capacity of quickness of perception is doubtless one of the elements conditioning the speed of reading. The sensory data must be transmitted over the afferent optic nerves to the visual and thought centers in the brain; the complex response transmitted over the efferent neural paths involves as a rule not only the motor aspects of perception but usually those of vocalization as well. This is evidenced by the usual presence of inner speech in silent reading. While it is true that the interfixation movements and the return sweeps consume but a small percentage of the total reading time, it is probable that the neural factor influences the duration of the fixation-pauses as well as the subsequent movement.

Here, however, as in the case of the central factor, it is doubtless true that the speed of the reading habits of most individuals is well within the upper limit of their neural reaction time. Huey reports the visual reaction

time to be 206.90σ (average deviation 20.7σ); while Dodge quotes averages ranging from 151.00σ (mean variation 9.9σ) to 181.00σ. These appear to be shorter than the average duration of a fixation-pause in reading. After a study of the comparative length of the fixation-pause and the visual reaction time, Schmidt concludes: "It is not probable that the average of the pauses in a given selection would be shorter in duration than the reaction time of the eyes."

Furthermore, Schmidt, whose technique was well adapted to secure accurate measurement, reports that the rate of the interfixation movements and of "the return sweep is not absolutely constant in the case of any one individual, variations from time to time being by no means uncommon." Here again there is an upper physiological limit to speed of reading, but the rate of an individual's ordinary reading seldom approaches within even striking distance of this maximal neural limit fixed by the rate of the ocular neural conductivity. Whether this neural reaction time is itself subject to improvement through training is an interesting question upon which the present study seeks to throw some light.

15. *The Visual Type of Imagery*

In the literature of the psychology of reading there are found some writers who think that the speed of reading is largely determined by the subject's dominant type of imagery. Quantz (26) interprets the results of some of his experiments to indicate the superior ra-

pidity of readers employing the visual type of imagery over those using the auditory type. Quantz further concludes that "the motor tendency in any degree has an influence detrimental to the rapidity of reading, and the stronger the tendency, the greater the hindrance." Schmidt states quite definitely that the speed of reading is conditioned by the dominant mode of imaging. The visual type constitutes the rapid readers, the motor type the slowest, while the "auditory type ranges between the two." As the whole question of imagery in reading is closely tied up with the problem of speed in reading, a more detailed consideration of the influence of the various types of imagery upon the reading rate and an examination of the evidence on this point will be found in Chapter VI — Training in Perception.

Miscellaneous

Besides the factors just enumerated there are others whose influence upon the rate of reading has engaged the attention of various investigators. Beer, Messmer (43), and Dearborn investigated the influence of the length of words upon the rate. Both Beer and Messmer found that a passage in which monosyllabic words predominated required more time. This fact was ascribed to the relatively greater number of ideas contained therein. Dearborn, however, maintains: "It is not the short words as such, but the words which cannot easily be grouped with others which necessitate separate fixation."

The investigation conducted by Huey to determine the effect of changes in the size of the type upon the rate shows that the unit of recognition of reading is but very slightly affected by changes in the sensory content, *e.g.* changes in the size of the type do not cause proportionate changes in the number and length of the pauses. Consequently, the rate of reading is but very slightly affected. These last mentioned investigations and others involving relative legibility of letters have not, in the judgment of the writer, disclosed factors of any appreciable influence upon the rate which could be incorporated into types of training to increase the speed in silent reading.

It is thought that every factor which experimental investigation or strong *a priori* reasons have indicated to be of consequence in conditioning the rate of reading has been enumerated above. The attempt has been made to blend the factors into various methods of training to accelerate the rate in silent reading. Three distinct methods have been formulated. They possess many factors in common. They differ from one another chiefly because each method is based upon a distinct principle of training.

By applying these methods of training to hundreds of pupils in various grades of the elementary schools, three to eight inclusive, evidence of an empirical nature will be secured to ascertain how speed can be developed and to determine some of the factors conditioning its development. The application of these types of train-

ing to pupils in the schoolroom serves therefore as an actual test of the efficacy of the previously mentioned factors and renders possible the valuation of their effectiveness. The formulation of the three types of training which have been developed will accordingly be presented in the following chapters.

CHAPTER IV

TYPE I. TRAINING IN RAPID SILENT READING

On the general principle of psychology that one learns to do a thing by actually *doing* it, it would seem logical to assume that one could learn to read rapidly by practice in rapid reading. In contrast with methods which analyze the reading complex into its main processes, and then devise types of training adapted to improve each of these specific processes separately, this may be said to be the direct synthetic mode of attack — training in the whole organized process of reading itself. This would seem to be the simplest and, at the same time, the most indispensable type of training.

In the case of the specialized type of training adapted to secure the improvement of a single specific process, such as visual span, or character of eye-movement, in the reading complex, there is always the possibility that the improvement effected under controlled circumstances may not be carried over into the actual reading situation, where the circumstances affecting the functioning of a single isolated process can no longer be controlled. This may be due, among other causes, to the

change in the reading situation which produces a corresponding modification in the response; or it may be due to the simultaneous functioning of other processes in the complex which tend more or less to inhibit or otherwise to affect the mode of operation of the specific factor subjected to the specialized training. Thus, for example, training to increase the perceptual span by means of tachistoscopic exposures of single disconnected phrases may actually — at least in the case of children — succeed in enlarging the visual span for such a type of reading. But whether the visual span enlarged for that specific type of perception would carry over into a different situation, such as obtains in the reading of a selection of continuous closely related subject matter, is uncertain.

For, in the latter case, the situation differs considerably from the former. The subject matter is no longer divided into phrases adapted for perception in a single fixation, but has all the words closely following one another in the printed line. There is, furthermore, a central thread of thought running through the various phrases and sentences of the context, which furnishes meaning premonitions of the coming words and phrases, thus enabling them to be grasped in much less than the normal perception time. Their meanings are more or less anticipated and peripheral vision seems sufficient to confirm the correctness of the conjecture, without requiring direct fixation of the foveal area. The wellnigh complete absence of these meaning premonitions

in the reading of discrete words, or phrases, exposed serially by means of the tachistoscope, shows how radically one reading situation may differ from another. It illustrates, moreover, the difference in the factors which are called into play, as well as the difference in their mode of functioning in the interpretation of the printed symbols, according as the reading situation varies.

Considerations such as the above serve to emphasize the value of the direct method of attacking the problem of accelerating the rate in silent reading. They show the need of training in various reading situations by supplying different types of material and presenting different aims or purposes for which the reading is to be done. They indicate, likewise, the necessity of employing certain precautionary devices to effect the transfer of the improvement in the functioning of a single specific process in the reading complex which was secured under controlled conditions, over into the ordinary type of reading. In the present investigation the specialized types of training have, in every case, been supplemented with practice in actual rapid reading in order that the improvement effected in a single factor may be rendered more likely to persist in ordinary reading.

The general question of the transfer of specialized training over into totally distinct and different mental operations is not raised here. All the specific processes that have been singled out for training in the present

investigation have not only a close kinship but many elements identical with the ordinary reading complex. The manner of effecting a persistence of the improved functioning of a single process becomes largely a matter of adapting the supplementary reading situation so as to evoke the desired type of functioning of the factor subjected to the previous specialized training. This will be exemplified in the subsequent exposition of the specialized types of training — No. II and III. These considerations are mentioned here to differentiate clearly the types of training developed in this study, and to point out the characteristic of this first type of training, namely, its *direct synthetic* mode of attack.

The present habits of reading are largely the result of indifferent practices. Up until the last few years there has been little or no recognition of the value of speed in reading and consequently but little or no systematic attempt to acquire it. The school's stress upon oral exhibition has excluded such an attempt. The first step in the development of habits of speed is the breaking up of the present slow, plodding habits of reading. Habit, as James has pointed out in his classic treatment of this subject, is best overcome by a contrary habit. So, in reading, slow, dawdling habits are best destroyed by practice in the opposite type of activity — rapid, alert reading — until that type becomes habitual.

To hasten the establishment of such habits and the

breaking up of the defective ones, the reading should be done at top speed. This will probably cause some difficulty at first and be somewhat trying. The latter seems to be the inevitable accompaniment of the substitution of one type of habit for its opposite. Reading at maximum speed, however, seems to be more effective and more prompt in the establishment of the desired type of ocular motor reactions than the "gradual tapering off" of the slow dead-level plodding pace.

To secure the highest speed and to prevent a relapse into the slower eye-movement habits, certain devices are essential. First, the reading stretch should be brief. Preliminary experimentation showed that it was very difficult to maintain the highest pitch of speed for more than three or four minutes. The element of fatigue quickly sets in where the effort is of the most intensive sort and causes a decline in the rate of speed. Accordingly, in the present investigation, the reading period was divided into stretches lasting usually two or three minutes with an occasional variation of a four-minute period. The instructions stated that a reading stretch should seldom, if ever, exceed four minutes. The pressure of a time-control, the individual graph, and the class chart were likewise helpful in maintaining the speed at the highest rate of which the readers were capable at the time.

All the factors enumerated in Chapter III, with the exception of No. 2 — Training to Decrease Vocaliza-

tion, and No. 3, — Training in Perception, have been incorporated into this type of training in rapid, silent reading. The inclusion of all these factors, and the presentation in brief outline of the resultant method proved a rather difficult task. While the adequate exposition of many of the factors involved, and of their relative importance, would have required considerable space, it was felt that the statement of the method, which was to serve the teachers also as a set of "directions for procedure," should be brief. It is, at best, a somewhat difficult and delicate undertaking to translate a set of written directions into the correct mode of procedure. If the directions are involved and complicated, the difficulty is enhanced, and the chances for confusion and divergences of procedure are correspondingly increased. Accordingly, an attempt was made to present the essentials of the method in the following brief outline or statement of Type I — Training in Rapid Silent Reading. A copy of these directions was sent to each teacher using this method.

STATEMENT OF
TYPE I. TRAINING IN RAPID SILENT READING

For the Teacher. The purpose of this investigation is to determine the extent to which speed in silent reading can be increased by training the pupils in this practice for a specified length of time. The practical value of a type of training which will accelerate the rate of silent reading is obvious. Your coöperation in this study will aid in definitely ascer-

taining means of accomplishing this end. The results of this investigation will be sent to every teacher participating in the work.

The period of training in rapid silent reading should last from April 8 until May 29. It should replace the regular work in reading and no other classroom time should be devoted to reading. Thirty minutes per day should be allowed for the work. Since the time element enters into all the work, a clock should be placed in the front of the classroom so that it can be seen by all the pupils. The method should consist essentially of alternate reading and reproduction. The reading should be timed and a measure of the amount read in the time allowed should be regularly taken. Pupils should be kept informed of their speed of reading. Reproduction should consist both of free paraphrase — orally, or in writing — and of answers to specific questions based on the text. The length of the reading period and of the reproduction period should vary with the grade of the pupils and with the subject matter. In general, however, the reproduction should not occupy more than one-quarter of the total time allowed for the exercise.

Only interesting material should be selected. It should also be easily within the understanding of the pupils. Since the object is to set up habits of rapid reading, emphasis upon the simplicity of the selection is necessary.

In order to assist the pupils in covering as much reading matter as possible, a definite preparation may be made consisting: (*a*) of thought preparation, or (*b*) of word preparation, or (*c*) of both. The thought preparation should consist of such an introduction by commentary or by the question-answer process as will arouse interest and enlist the attention of the pupils. This preparation should in no case be long. For the word preparation, the teacher should select such words as in her judgment would be unfamiliar to

the pupils, and should present them briefly, explaining their meaning. The preparation — both thought and word — may be abridged or even omitted when the material is such as to give no difficulty. In no case should the preparation occupy more than five minutes of the 30 assigned to the exercise.

Each pupil should keep a chart of his daily performance, and a complete chart of the daily class performance should be conspicuously displayed in the classroom.

It is desirable that the directions to pupils given by each teacher concerned in this investigation be substantially the same. The following points are suggested indicating the nature of the direction. Literal adherence to them is not requested. Their spirit, however, should be maintained.

Point out the advantage of a rapid rate of reading. Try to get the children to see this in terms of an addition to their own interests and pleasure. Carefully direct them where to begin the assignment of the day. See that they all begin at the same time and at the same place in the text. Say in substance: "Read it as fast as you can. I want to see how much you can read in two (or three) minutes. But remember that I am going to ask you to tell me about what you have read so do not skip anything. Try to read faster to-day than you did yesterday." See that the pupils have a pencil at hand and direct them to stop reading at once as soon as you say "stop." Direct them then to mark the end of the line which they are reading when told to stop. Pupils may now reproduce what they have read as indicated above. In a similar manner, reading and reproduction are to be continued till the end of the 30 minutes assigned. Have the pupils then report the number of pages and lines beyond the last full page which they read.

As part of your preparation for the exercise you will be expected to know the average number of words per line in

the matter which is being read and the number of lines per page (if pages are broken by illustrations, or for other reasons, special account of these pages will have to be taken). From the pupils' reports as to pages and lines read, on this and subsequent assignments for the day, estimate the number of words read that day and divide by the total number of minutes used in reading. This will give the number of words read per minute. Each pupil should figure out his own score, and should immediately enter it upon the chart, which will thus serve as a record of his daily progress in silent reading.

On May 1, and May 28, besides the record of the average number of words read per minute by each pupil during the total reading time, a record of the average number of words read per minute by each pupil during each of the various reading periods constituting the total time devoted to reading on each of the above mentioned days should also be kept.

On May 2, and May 29, the pupils should be tested with the Courtis Silent Reading Tests, Forms II and III, respectively. As soon as possible after May 29, a copy (or the originals) of the individual charts, the class chart, and a record of results and observations should be mailed to the Bureau of Educational Research, University of Illinois, Urbana, Illinois.

To clear away any misconceptions in regard to the various points in the statement of the method, and to insure uniformity in all the important steps in the procedure, a representative from each of the school systems participating in the experiment was invited to a conference at the University of Illinois. Here the application of the method was demonstrated to the visiting delegates by a teacher and her pupils from

one of the Champaign public schools. Miss Davis, the teacher demonstrating the method, had previously been instructed in its application by Dr. Buckingham and the writer. Besides the ocular demonstration, queries from the delegates concerning various details of the method were answered, and its adjustment to particular classroom conditions was explained.

As a result of the questions which arose at this conference, the following topics seem to require additional discussion: (1) Length of Reading Period, (2) Alternate Reading and Reproduction, (3) Thought Preparation, (4) Word Preparation, (5) Directions to Pupils.

1. *Length of Reading Period*

Thirty minutes was specified as the length of the reading period for all the grades participating in the experiment. This amount was decided upon after investigations showed a range from approximately 120 minutes devoted to reading in some third grades to only about 15 minutes allotted to reading in the seventh and eighth grades in some schools. Furthermore, considerable variation in the amount of time devoted to reading in even the same grades was found to exist among school systems in different cities. Since the investigation extended to all the grades from the third to the eighth, a reading period that was to obtain throughout these six grades would necessarily have to be somewhat of a compromise between the extremes. The heavy curriculum of an eighth grade precluded the

possibility of devoting an hour and a half daily to reading. On the other hand, the teachers in the third grade felt that the abbreviation of the reading time to a single 15-minute period could not be done without causing a rather serious impairment of the progress of the pupils. Accordingly, a 30-minute period was decided upon as representing an approximate average of the amount of time devoted to reading by the six upper grades in the elementary schools.

The allotment of this specific amount of time carries with it, therefore, no implication of a normative character. It does not pretend to represent the proper length of the reading period for all the six grades mentioned. The amount of time assigned to reading will naturally vary from grade to grade, less time being allotted to the formal reading period in the upper than in the lower grades. A reading period of 30 minutes was decided upon in the present investigation solely for the sake of uniformity. For, obviously, the amount of time devoted to the training must be uniform if comparisons are to be made between the amounts of progress made by the different grades. This uniformity in the allotment of time renders possible a comparison of the extent of gain registered by the third grade pupils with that made by, say, the fifth or eighth grade pupils. Without this uniformity in the length of the reading period throughout all the grades a common basis of comparison would be wanting.

Comparisons, such as the above, may be expected to

throw some light on the interesting question: In what grades do the pupils show the greatest susceptibility to improvement in reading rate? From the answer to the above question there flows a corollary of practical value to the school concerning the relative stress to be placed upon the formation of habits of rapid silent reading in the different grades of the elementary school.

2. *Alternate Reading and Reproduction*

While this study is concerned chiefly with the acceleration of the rate, it is recognized that the development of speed at the expense of comprehension does not make for efficiency in reading. Accordingly, means were adopted not only to safeguard the comprehension and to prevent its impairment, but also to effect, if possible, a development in assimilative capacity that should advance *pari passu* with the growth in speed. For this purpose after each reading stretch of two or three minutes the pupils were called upon to reproduce. Recognizing that reading in actual life situations is done not for one constant adamantine purpose, but for a great variety of ends, such as to "get the gist," to answer certain specific questions, to get the central thought, to secure a certain point of information, the reproduction in the present study was made to assume a like variety of forms. Sometimes a pupil would be called upon to reproduce the main thought of the selection; at other times specific items of information,

important facts, names, and causes, would be requested. Thus the development of a single, narrow type of reading ability was guarded against, and a rather well-rounded, many-sided reading activity was brought into play.

The teacher was advised to have her questions and her other methods of testing the comprehension formulated, at least to some degree, in advance. Preliminary experimentation showed that no small amount of time was lost by the teacher in deciding what to ask about the passage just read by the pupils. This hesitancy and indecision slowed up the whole procedure, consumed a considerable share of the time, and reacted unfavorably upon the "keyed-up" mental "set" of the pupils. By having the questions, or at least the cues to them, written in the margin of the book, this source of wastage was eliminated.

The teachers were advised to scatter the questions promiscuously among the class, so that every pupil would feel himself constantly exposed to a call. This would tend to prevent skipping or skimming and insure perusal. If a pupil were found unable to answer a simple question on the matter he purported to have read, the teacher was encouraged to test him in the subsequent reproductions to show him the need for greater comprehension in his reading as well as to prevent cheating.

Because of the large element of guesswork which they invite, questions of a simple "Yes" or "No" variety

were not encouraged. Sometimes the reproduction was in writing. This insured the testing of each pupil. Usually, however, oral reproduction was called for. Since the development of habits of speed was especially aimed at, the suggestion was offered that the reproduction should not, as a rule, be too detailed — demanding nonessential particulars and points which a reader in an actual life situation would seldom be expected to remember. Such a procedure would naturally militate against the formation of habits of rapid assimilation by its disproportionate and unnatural stress upon unimportant details. It would tend to eliminate the functioning of extra-foveal vision, by necessitating the careful and even scrupulous fixation of each word. A slow, plodding type of reading, devoting as much time to the fixation of a mere preposition or article as to the subject of the sentence would be the not unlikely result of such a procedure.

Preliminary experimentation disclosed the lurking of another danger in the application of the method. When the method was first tested out, a tendency was observed for the teacher to consume the bulk of the period with the mechanical details, getting the class ready to read, reproducing the material read, and computing how much was read. Under these circumstances, a comparatively small portion of the total time was devoted to actual practice in rapid reading. Thus, in the preliminary experimentation, a teacher was found to consume four minutes in pre-

paring the class to begin reading, and ten minutes in each of the two reproductions which consisted of halting questions and slower answers. The result was that she secured but two reading stretches of three minutes each. Thus, out of a 30-minute period, but six minutes were devoted to actual reading. This was distinctly contrary to what was intended. Accordingly, the instructions stressed the necessity of prompt, rapid reproduction.

The reproduction should be short and brisk — just sufficient to convince the teacher that the pupils have grasped what they have read. While no ironclad rule was laid down specifying the amount of time to be used for each reproduction, the general direction was given that the reproductions all together should not consume more than one-quarter of the total reading period. The short periods for reproduction following each reading stretch afforded the pupils an opportunity for temporary relaxation, thus preventing the onset of fatigue and rendering it possible for them to maintain the reading rate at its highest pitch.

3. *Thought Preparation*

The introspection of trained students as well as casual observation show that most readers are slow in getting started. There usually occurs what psychologists call the "warming up" (*Anregung*) period, before the individual gets into "the swing" of it (*Gewöhnung*). The length of this warming up period varies with

different individuals and with different materials. That such a warming up process is not necessary, however, was made evident by preliminary experimentation on this point. The pressure of a time-control proved instrumental in replacing the listless attitude with one of prompt, concentrated attention. At the sound of the word "Go," the reader started at a high rate of speed. A record of the number of words read during each of the minutes in a five-minute period shows that it is possible for a reader to strike practically his highest level of speed in the initial minute. The reason why the reading often starts at a slow dawdling pace is because the interest is not yet aroused. In the present study, the pressure of a time-control was chiefly instrumental in securing prompt concentration of attention.

As an auxiliary to this device, however, the thought preparation was utilized to enlist the immediate interest of the reader in the selection. The thought preparation was of different kinds, varying largely with the character of the subject matter. Thus, in a narrative selection, sometimes it was found advisable to trace in a few deft sentences the outline of the story leading up to the climax and then suddenly stopping. The children in many such cases could hardly wait for the signal to begin, so anxious were they to "find how the story came out." Sometimes the end could be attained by saying a few words about one of the main characters, by sketching the background of the story, or by briefly outlining the life of the author. The character of

the thought preparation was found, furthermore, to depend upon the general interest manifested by the pupils in the training to increase speed. In many classes, where the pupils entered whole-heartedly into the experiment, no such device was needed to enlist the already keen interest of the pupils. The method was left rather flexible to enable the teacher to adapt it to suit the different types of subject matter and the varying needs and interests of the class.

4. *Word Preparation*

In the lower grades especially, it was found advisable to devote a few minutes to a consideration of the meaning and the pronunciation of some of the more difficult or unusual words which the pupils would encounter in the selection. By writing them on the blackboard along with their meanings, before the pupils commenced their reading, the obstacles which might have retarded their progress were eliminated in advance. In the upper grades but little of this word preparation was found necessary. As a rule, it occupied but a few minutes. In no case was the preparation — both thought and word — permitted to consume more than five minutes of the thirty assigned to the exercise.

5. *Directions to Pupils*

Considerable care was taken to point out to the pupils the advantages of rapid, efficient reading. They were made to feel the need for such training by awakening

in them the consciousness of their present slowness and inefficiency. From this need there sprang the earnest desire to secure such training. They were given plainly to understand that in the measure in which they entered earnestly and enthusiastically into the undertaking, just in that measure would they reap the results.

In an endeavor to establish regular, rhythmical habits of eye-movements and to utilize to some extent peripheral vision the pupils were advised to "run their eyes along the line" as fast as they could grasp its meaning. The pupils were urged to put forth their best efforts to read as fast as possible. The Board of Education of New York advises that pupils be urged to read rapidly, but not to hurry. This distinction without a difference found no application in the present set of instructions. The pupils were frankly urged to "speed up" their reading. The reservation adopted here, however, was that they understood what they read. They were free to hurry as much as they could, provided they grasped the meaning. The highest possible rate of speed consistent with an assimilation of the subject matter was the ideal placed before each pupil. This direction had its basis in the conviction that such a procedure would be the most prompt and efficacious in breaking up the existing slow, plodding habits of reading and in establishing in their stead the opposite type of reading habits.

It is thought that the above statement contains the essentials of Type I. The results of the application of this method will be presented in a subsequent chapter.

CHAPTER V

TYPE II. TRAINING TO DECREASE VOCALIZATION

What is the nature of the so-called "inner speech" of silent reading? Is it always present in such reading? Why is there such a process as vocalization in silent reading at all? What is its origin? What rôle does it play in the gathering of thought from the printed page? Is it necessary in reading, or may it be eliminated, or at least abbreviated? If so, how? While these questions are of interest, especially to the psychologist, a brief treatment of them here will enable the general reader to appreciate the significance of this factor on silent reading, and to understand the *raison d'être* of this second type of Training in a study that aims at the acceleration of the reading rate. Many of the above questions cannot, it is true, be answered as yet with certainty; but recent investigations have served to throw some interesting light upon this rather strange and mysterious accompaniment of silent reading.

Definition

Huey's definition of inner speech in silent reading as "a combination of auditory and motor elements, with

one or the other predominating according to the reader's habitual mode of imaging" may be said to reflect fairly well the general view of students who have investigated this process. In other words, reading is not confined to the visualization of the printed symbols. Concomitant with this visualization there occur movements, more or less incipient in character, of the tongue, lips, vocal chords, larynx, inner palate, throat, and the general physiological mechanism that functions in oral speech. The reader goes through the form of saying the words to himself. The difference between the inner speech of silent reading and the oral speech of conversation is thus seen to be one, not of kind, but of degree — degree of movement of the vocal organs, and degree of sound produced.

History of the Study of "Inner Speech"

While this habit of vocalization in silent reading and even in thinking seems to have been always with us, its existence does not seem to have been consciously adverted to and commented upon until the second half of the last century. Ribot (44) seems to have been one of the first to have called attention to this phenomenon. Writing in the *Revue Philosophique* in 1879, Ribot observes "L'homme fait, qui lit silencieusement, accompagner chaque perception visuelle d'un mouvement secret d'articulation."[1] This observation occurs

[1] "In silent reading, every visual perception is accompanied by a concealed articulatory movement."

as an *obiter dictum,* as Ribot was primarily interested in demonstrating the general importance of movement in connection with psychical processes. The case of inner speech in reading is cited merely as a specific illustration of the general law of psycho-physics, by which every sensory stimulus terminates in a motor reaction. In the literature in English the first clear reference to the existence of this habit appears to be the statement of Bain (45) in 1868: "A suppressed articulation is, in fact, the material of our recollection, the intellectual manifestation, the idea of speech." In the statements of these psychologists one can see the foreshadowing of the present pragmatic theory of consciousness, in which the incipient motor tendencies of the type just mentioned are made to play stellar rôles in explaining the functioning of the various types of thought and ideation.

The first systematic treatment accorded this process seems to have come from the pens of the French psychologists, Egger (46) and Ballet (47). Relying on introspection, Egger notes the constant persistence of this inner speech in both his thinking and reading. The latter he thus aptly describes, as quoted by Pintner (48): "Lire, en effet, c'est traduire l'écriture en parole:"[1] and of thinking, he says, "À tout instant, l'âme parle interieurement sa pensée."[2] Ballet calls attention to the additional factor of audition in reading, pointing

[1] "To read is, in reality, to translate writing into speech."

[2] "In every instance, a person expresses his thought in inner speech."

out the intimate connection between the articulation of words and the hearing of them. Whether or not audition always follows on the articulation of words, Ballet does not state.

Somewhat more positive and dogmatic was the conclusion reached by the German psychologist Stricker (49) that it was impossible to have an idea of a word without experiencing the sensations of innervation arising from the stimulation of the articulatory muscles in inner speech. For example, it is impossible to have an idea of the sound of the letter B without feeling an incipient muscular movement in the lips. As he himself expressed it: "Die Vorstellung des Lautes B und des Gefühl in der Lippen sind also in meinem Bewusstsein unzertrennlich assoziert. . . . Diese Gefühle sitzen in den Muskeln." [1] Indeed, not only are sensations of movements in the articulatory muscles inseparately connected with the letter or word, but the consciousness of these muscular movements really constitutes the idea of the word. Since Stricker supplemented the results of his own introspection by questioning a hundred other observers, and finding similar results, his conclusions assumed the nature of generalizations of a rather universal character. To the question then, Is inner speech necessary in silent reading and even in thinking? Stricker answers unequivocably in the affirmative.

[1] "The mental image of the sound B and the (corresponding) sensation in the lips are inseparably associated in my consciousness. . . . These sensations arise from the muscles."

Stumpf, Paulhan, and Baldwin agree with Stricker that abridged articulatory movements are usually present; but that they are necessary, or even, *de facto*, always present, they deny. Pushing Stricker's theory concerning the necessity of articulatory movements to secure the idea of a word to its logical conclusion, that the idea of a tone must likewise be impossible without the corresponding articulatory movements, Stumpf (50) endeavors to refute it by citing his own ability and that of other musicians to recall a tone without movement of the articulatory muscles. "Ohne lautes, leises oder stilles Singen kann ich verschiedene Töne vorstellen."[1] Paulhan instances his ability to have an auditory image of one vowel while pronouncing a different one aloud — an impossible performance according to Stricker's conclusion. Paulhan points out that Stricker's conscious advertence to the articulatory movement was probably instrumental in causing the movement. While previous writers had called attention to the close connection between the motor and the auditory elements in inner speech, but had given no definite answer as to whether the one could exist without the other, we find Paulhan (51) stating that the auditory may be present even though the motor be lacking. Whether the motor element may exist without arousing the auditory, Paulhan does not decide. Differing somewhat from Egger, he maintains that thought is an inner

[1] "I can recall different tones without singing loudly, softly, or silently."

language which need not necessarily be converted into words or verbal imagery — "la pensée est un langage, non une parole, et, si la représentation des mots lui est utile, elle paraît, de son côté, faciliter beaucoup cette représentation." [1]

In general consonance with the conclusions of Paulhan, Baldwin (52) cites his ability to image a note while in the very act of uttering another vocal sound in a different pitch. He does not find the movement of the articulatory muscles a necessary condition for the imaging of the word — the latter being produced even when the articulatory muscles are held rigidly motionless. Baldwin states that when his attention is withdrawn from the larynx and directed to the ear, the movement of the former disappears. In view of the faint vestigial character of the movement, however, the question might well be raised here, whether the movement really disappeared, or whether it was merely *not perceived* because the attention was withdrawn from it. In the writer's judgment, the latter is only too probably the case. Bastian (53) and Collins (54) oppose the theory of Stricker and Bain on more purely anatomical evidence. The latter instances a case of cortical motor aphasia in which articulatory movement was entirely lacking though the patient was nevertheless able to read.

In an introspective study of his own silent thinking,

[1] "Thought is a language, not a speech, and if the verbal imagery is useful, the idea seems in its turn to facilitate greatly the appearance in consciousness of such imagery."

Dodge (55) found inner speech was clearly present. Reproductions of movement sensations from the various organs that function in actual speech — the tongue, lips, throat, thorax, — seem to constitute the essential elements of the words. An interesting distinction is drawn by Dodge between the sensations coming from the actual movements of the organs of speech and the ideas of those movements. The latter Dodge maintains are indispensable; the former are not. Bawden (56) supports this conclusion, also maintaining that kinæsthetic or motor ideas suffice to constitute the meaning of words, even when actual articulation or movement of the muscles is absent.

Thus far the psychologists had relied solely upon introspection to detect the presence of articulatory movement. An effort was made by Curtis (57) to remove this matter from its complete dependence upon the subjective factor of the subject's own introspection and place it upon an objective basis. Accordingly, he placed a large tambour on the larynx of the subject. A record of the movements made while the subject was thinking or reading silently was compared with the movements made when the subject was relaxed, thinking of nothing in particular. The curves of the former were much larger than those of the latter. Following this same mode of attack, Courten (58) at the University of Yale employed a Rousselot exploratory bulb which rested upon the tongue, and was connected with a Marey tambour. Since the tongue is one of the

important organs called into play by articulation, a record of the movement or non-movement of the tongue would throw some light on the question: Does a suppressed vestigial articulation always accompany silent reading? Courten found that the curve of movement varied both with the individual and with the degree of concentration in thinking and in reading. In every case, however, movement of some sort was clearly recorded.

From the above mentioned objective findings two inferences would seem to follow.

1. Too much weight should not be placed upon the report of a subject whose introspection is unable to detect a slight movement of the articulatory muscles.

2. The absence of articulatory movement in some degree or other does not seem to be conclusively demonstrated in any individual case.

While the articulatory movements that occur in thinking and in silent reading are usually of a faint vestigial character, there are occasions when the articulation becomes very pronounced. Hansen and Lehmann (59) have shown that when the subject is thinking very intently of some name or number an unconscious whispering usually occurs. Though accompanied by no perceptible movement of the lips, the sound can nevertheless be distinctly heard by observers when the subject is placed in especially favorable acoustic conditions. These experimental findings of Hansen and Lehmann offer corroborative experimental evidence to

the observation made by Egger, in 1881, that there are certain mental states during which the inner speech is especially vigorous despite one's best efforts to check it — occasions when it is impossible to "faire taire notre pensée."

After reviewing the literature on this subject rather exhaustively, Pintner concludes: "The general result from all these experiments can be summed up by saying that silent reading is accompanied by articulation in some degree or other. This activity of articulation is, so far as we know, a universal habit. Whether it is a necessary habit is another question."

Origin of Habit of Inner Speech

Before investigating the latter question it would seem advisable to consider: What is the origin of this habit? The answer to this query may throw some light upon the former. Is articulation in silent reading the result of a habit of associating the sound of words with their visual appearance, which habit has been acquired through the process of education? Or is it more largely an inherited tendency? To this question Quantz (26) gives a very definite answer:

> "Lip movement in silent reading is not an acquired habit, but a reflex action, the physiological tendency to which is inherited. It is not 'second nature' but essentially first nature; not something to be *unlearned* but to be *outgrown*. It is a specific manifestation of the general psycho-physical law of 'dynamogenesis' by which every mental state tends to express itself in muscular movement."

Among the considerations which Quantz adduces to support the above statement are the following:

1. "The child in learning to read does not learn to move his lips. The lip-movement is most decided at the very beginning, and grows less so, as he becomes conscious of it and controls it voluntarily. In learning to write, also, the child moves his tongue and the muscles of his face; sometimes even his feet or his whole body. But he afterwards finds that this expenditure of energy is unnecessary. It is brought under control when the writing itself becomes partially reflex, leaving the higher conscious processes more free to attend to the inhibition of these lower useless ones. The same act is then performed more exactly, more quickly, and with less exhaustion. Similarly, lip-movement is an unnecessary expense of energy — not only useless but detrimental.

2. "In the answers to the 'personal sheet' many persons say that though not habitual lip-movers they do move their lips when giving very close attention, or when reading matter which is very difficult, absorbingly interesting, or highly emotional. This means simply that we regularly inhibit these vocal reflexes, but that when our whole attention is given to the thought under consideration the watchfulness over these motor tendencies is relaxed, and they find expression. We tend to 'think aloud' when preoccupied — not only lip-movement but actual speech is unintentional. It is true also that these impulses to vocal movement are stronger, and hence more likely to find an outlet, when the corresponding mental processes are more vivid. This follows from the general principle, experimentally demonstrated by Féré, that 'the energy of a movement is proportional to the intensity of the mental representation of that movement.'

3. "The statement that lip-movement is 'natural,' and reading without lip-movement an acquired habit, is entirely in accord with mental laws. The development of mind is not only in handing over processes once conscious to the control of the reflex mechanism — as in walking or playing a familiar tune on the piano — thus leaving consciousness free for the acquisition of higher powers and the performance of tasks more difficult; but the interchange is also in the opposite direction — originally reflex processes are frequently brought under the control of the higher consciousness, and inhibited if they are considered useless or detrimental."

The explanation of Quantz and the considerations advanced in its support seem to possess a certain amount of plausibility. On the general psycho-physical theory of dynamogenesis, one would naturally be led to expect some form of motor *reaction* to the mental processes involved in silent reading. The question might be raised here why this *reaction* should always take the specific form of movement of the musculature of articulation. The *nexus* between the mental processes involved in the assimilation of thought from the printed page and the movement of the larynx, tongue, vocal cords, lips, and the general physiological mechanism of articulation does not seem to be *per se* an obviously natural or necessary one. Why does not the motor reaction take some other form of outlet — the movement of musculature other than the articulatory? The theory of dynamogenesis might explain the presence of some form of motor reaction to the mental processes involved in the interpretation of printed sym-

bols, but taken by itself, it does not seem sufficient to explain why the reaction should always take the form of articulatory movement.

In the writer's judgment, it would seem that to explain this latter connection between the interpretation of printed symbols and the inner-vocalization of the symbols, recourse must be had to the *acquired* habits of speech and oral reading. The pronunciation of words is learned by the child either through unconscious imitation, or through express formal instruction. In either event it must be acquired through practice. Though the physiological capacity or tendency to speech is inherited, the actual pronunciation of words must be *learned.* Since speech is acquired before reading, words have meaning to the child at first only as sounds. The school ties on to these sounds certain visual symbols in the form of printed letters or words. The latter gradually become enriched with meaning through their evoking the proper sounds which arouse the corresponding meaning. The association between the visual form of a word and its sound is stressed by the school in the primary grades until the association becomes very intimate and, apparently, inseparable. Reading then consists of the stimulation of the visual imagery which in turn arouses the auditory and articulatory elements, whence only the meaning is reached.

The point made here is that the association of the printed word with its corresponding sound and articulation is *consciously and purposely built up by the school.*

The synaptical connections between the visual, the auditory, and the articulatory centers in the nervous system are thus made closer and closer. The mental associations and the synaptical connections are not inherited, however, but are acquired as the result of practice and training — be it conscious or unconscious in character.

There is no intrinsic reason why the visual form of words must necessarily be associated with their sound in order to convey meaning. It is simply a matter of economy of effort. Since ordinarily the average person deals with words first as sounds, and continues later to use them, to a great degree, in actual speech, the school simply capitalizes the stock of meanings already attached to the sounds by associating the sound of words with their visual form. It would still be possible, however, to link the meaning of words to their printed form through the direct medium of the visual imagery, or through the tactile channel, without employing the intercessory assistance of the auditory element. In teaching the deaf and dumb to read by the manual method, this appears to be precisely what is done. The auditory is naturally entirely lacking, the visual imagery together with the kinæsthetic being employed to convey directly the meaning of the visual symbols.

Moreover Quantz's statement that "lip-movement is 'natural' and reading without lip-movement is an acquired habit, is entirely in accord with mental laws"

needs to be examined rather carefully. It is undoubtedly true that the musculature of the lips as well as all the other muscles of the body is gradually called into play as the physical organism develops from infancy to maturity. But the movement of the lips and other articulatory organs that accompanies silent reading is not simply movement of a *generic* character. It is the definite *specific* form of movement that occurs when the words that are being read are actually pronounced. As Huey well observes, "while the inner speech is but an abbreviated and reduced form of the speech of everyday life, a shadowy copy as it were, it nevertheless retains the essential characteristics of the original." Now, while it is to be admitted that the movement of the lips and of the motor organs is natural as the organism develops, and while some form of motor reaction to the various mental processes is to be expected on the psycho-physical theory of dynamogenesis, the peculiar specific form of the lip and other articulatory movement — such as occurs in actual speech — is still left unexplained.

The explanation is to be found not in the list of inherited tendencies or connate reflexes, but in the acquired habits of the individual. The mastery of the phonetic properties of words, and their correct pronunciation — requiring, as they do, particular types of lip maneuvers, the careful manipulation of the tongue, and other delicate and "unnatural" articulatory movements — have not alas been inherited, but are the re-

sult of conscious training and much practice, as every primary teacher realizes only too painfully. The kind of articulatory movement that accompanies silent reading cannot therefore be said to be natural in the sense that it has not been learned or acquired. It has been acquired. But the constant association between the visual symbol of the word and its phonetic properties has become so deeply ingrained in the synaptical fibers of the neurones, through both the conscious linkage of these two by the school, and through the constant usage of a word in both its visual and auditory form in daily life, that the sight of a word comes to arouse its appropriate sound and its corresponding articulatory movements. Thus inner speech becomes an automatic reflex accompaniment of silent reading. But the point never to be forgotten is that it has been acquired — not inherited "ready made."

Is Inner Speech Necessary in Silent Reading?

The answer to this question is really implicit in the conclusion reached in the discussion of its origin; namely, that it is an acquired habit, not an inborn characteristic. Consequently it would seem theoretically possible to learn at the start to read through the sole medium of the visual imagery, or if the habit of inner speech has been already acquired, to inhibit the habit. By inner speech is here meant that definite specific type of suppressed articulatory movement which is similar in contour and general outline to the

larger movements of the gross musculature of articulation which functions in oral speech. The mere unconscious quiverings of an organ which have been detected by delicate instruments during silent reading, when the tongue, lips, etc., are held, for all practical purposes, rigidly motionless, would not therefore constitute inner speech as the term is used in this paragraph.

As a result of his experiment at the University of Chicago, in inhibiting articulatory movements in silent reading, Pintner (48) draws the following conclusions:

1. "That articulation during the reading process is a habit which is not necessary for that process.
2. "That practice in reading without articulation can make such reading as good as the ordinary reading of the same subject.
3. "That practice in reading without articulation tends to aid ordinary reading, most probably by shortening the habitual practice of articulation."

Similar to the above is the conclusion reached by Secor (60) after his experiment on this subject at Cornell, namely that "articulation and audition" are not to be regarded as "absolutely necessary elements."

The conclusion reached by Pintner and Secor is further confirmed by the observation of W. A. Schmidt (7):

"It is quite possible, too, that if training in oral reading were discontinued at an early stage, and training in rapid silent reading were stressed, the tendencies toward inner speech might be greatly reduced and visualization cultivated,

at least in part. As a matter of fact, we appear to have the ability to take in all kinds of situations visually without speech accompaniments. This is true even in the case of the interpretation of many printed symbols."

Means of Inhibiting Inner Speech

From the conclusion that articulatory movements are not necessary in silent reading to the devising of means of inhibiting them is rather a far cry. Their inhibition is another matter. And the validity of the former conclusion does not depend upon the successful execution of the latter. Various devices have been employed to inhibit articulation. Secor reports that whistling and the uttering of the alphabet aloud "completely removed all traces of articulatory movement, so far as the possibility of discovering this by introspection is concerned." Though the saying aloud of a letter or word would apparently engage the musculature of articulation during the moment of actual utterance, there would still remain the possibility of inner movement during the intervals between the words which would be likely to escape introspection. To guard against such interstitial movements, the subjects were requested to read while prolonging a letter as much as possible. This served but to verify the results of the previous introspection — that no movement occurred. In the writer's judgment, however, even this last method does not necessarily remove the possibility of a faint, subtle, vestigial movement of some of the

smaller articulatory muscles which are obviously not employed in the simple prolongation of a letter.

Pintner had his subjects count aloud the series 13, 14, 15, 16; 13, 14, 15, 16; etc., while reading silently. The pronunciation of these numbers requires a more elaborate musculature of articulation than the simple letters of the alphabet used in Secor's experiment. The introspection of Pintner's two subjects reported a complete absence of articulatory movement, though audition still remained in the case of one of the subjects. Incidentally the introspection of the latter observer casts an interesting ray of light upon the relationship between the motor and the auditory elements in inner speech. If the introspection reflects his actual mental experience, it shows that the union between the motor or articulatory element and the auditory is not nearly so inseparable as many writers have supposed. It lends no corroboration to the generalization made by Huey (6): "The fact is that what we say is always heard as well, and there comes to be an indissoluble union of the auditory and motor elements."

As a result of this phase of his experiment, Pintner concludes: "I think we are justified in saying that reading without articulation can take place, . . . and that practice in reading without articulation increases the ordinary rate of reading, no doubt due to the fact that after such practice the amount of articulation made use of is not so great as formerly."

No satisfactory method has yet been devised of ex-

cluding audition in silent reading. Secor found that the playing of a xylophone near the observers quite as often as not left the inner hearing undisturbed. Similarly, loud noises seemed ineffective in suppressing the inner auditory accompaniment in the silent reading of most people.

In concluding this brief discussion of the history, origin, and nature of inner speech, it is only fair to say that when due allowance has been made for the findings of all the investigations on this subject, there still remains too much speculation and too few scientifically established facts; too much conjecture and too little certainty. The problem of inner speech — why we persist in vocalizing in silent reading — is still with us, shrouded in some of the pristine mystery which it presented to its first systematic investigators — Egger and Ballet.

It is hoped that this review of the investigations of inner speech has served to show at least the significance and importance of this factor in silent reading. It will give the reader a better and more intelligent insight into Type II — Training to Decrease Vocalization. The validity of this method does not depend, however, upon any of the tentative conclusions as to its origin, the relationship between the motor and auditory elements previously presented. Neither does it hinge upon the correctness of the answer to the theoretical question: Can every vestige of articulatory movement be inhibited? Prescinding from such theoretical con-

siderations, this method endeavors to decrease lip-movement and that form of articulation which notably hinders speed in silent reading. Whether or not a slight vestigial quivering of the larynx, barely detectable by a tambour, exercises any effect upon the rate is a theoretical question which does not concern us here. Certainly its effect, at most, is but negligible. But the more or less elaborate movement of the gross musculature of articulation, the tongue, lips, and throat muscles, has a very pronounced effect upon the rate, as every investigation of this subject has clearly shown.

A summary of the findings on this point showing the retarding influence of a marked habit of vocalization was presented in Chapter III. It was this evidence that showed the advisability of decreasing vocalization to increase speed, and was thus directly responsible for the formulation of this type of training. The evidence presented there is well epitomized in the conclusion of Huey: "The direct linking of visual form to ideas, cutting out of the circuit the somewhat cumbrous and doubtless fatiguing audito-motorizing mechanism, would seem to be a consummation to be wished for." Similar in effect is the conclusion of Dearborn: "The effect of articulating is to decrease ordinarily the span of attention" and consequently to retard the rate of reading.

The following is a statement of the second method, a copy of which was sent to every teacher using this method.

STATEMENT OF

TYPE II. TRAINING, TO DECREASE VOCALIZATION IN SILENT READING

Vocalization may show itself in rather extreme form by elaborate lip-movement, or in its usual form, by incipient movements of the lips, tongue, pharynx, vocal cords, and the general mechanism of the throat. The reader feels or hears himself pronouncing the words. This constitutes the so-called "inner speech" of silent reading. Inner speech is present in some form in the reading of most pupils.

Inner speech has the effect of slowing up the rate of reading, causing the individual to read no faster than he can actually pronounce the words to himself. Hence, perception must wait upon pronunciation. The rate of reading, in other words, is made dependent upon the rate of inner speech. If this process of vocalization be gradually lessened and finally eliminated, the rate of silent reading may be greatly accelerated. The period of training to decrease vocalization should last from April 8 until May 29. It should replace the regular work in reading and no other classroom time should be devoted to reading. Thirty minutes per day should be allowed for the work. The method should consist essentially of alternate reading and reproduction. The reading should be timed and the place in the selection reached at the end of each of the various periods should be regularly marked. Since the time element enters into all the work, a clock should be placed in the front of the classroom so that it can be seen by all the pupils. Pupils should be kept informed of their speed of reading.

Reproduction should consist both of free paraphrase — orally or in writing — and of answers to specific questions based on the text. The length of the reading period and of the reproduction period should vary with the grade of the

pupils and with the subject matter. In general, however, the reproduction should not occupy more than one-quarter of the total time allowed for the exercise.

Only interesting material should be selected. It should also be easily within the understanding of the pupils. Since the object is to set up habits of rapid reading, emphasis upon the simplicity of the selection is necessary.

In order to assist the pupils in covering as much reading matter as possible, a definite preparation may be made, consisting: (*a*) of thought preparation, or (*b*) of word preparation, or (*c*) of both. The thought preparation should consist of such an introduction by commentary or by the question-answer process as will arouse interest and enlist the attention of the pupils. This preparation should in no case be long. For the word preparation the teacher should select such words as in her judgment would be familiar to the pupils, and should present them briefly, explaining their meaning. The preparation — both thought and word — may be abridged or even omitted when the material is such as to give no difficulty. In no case should the preparation occupy more than five minutes of the 30 assigned to the exercise.

Each pupil should keep a chart of his daily performance, and a complete chart of the daily class performance should be conspicuously displayed in the classroom.

It is desirable that the directions to pupils given by each teacher concerned in this investigation be substantially the same. The following suggestions are offered, indicating the nature of the directions to be given to the pupils. Literal adherence to them is not required. Their spirit, however, should be maintained.

Point out the advantage of a rapid rate of reading. Tell them that their effort to read rapidly will be more successful if they avoid moving their lips and tongue and do not at-

tempt to pronounce each word to themselves. For it is precisely this attempt to pronounce each word which slows up the rate of reading. Articulation of words in silent reading, therefore, is a serious hindrance to rapid silent reading, which should be eliminated in the interests of efficiency. Try to get the children to see that their speed and efficiency in silent reading will depend largely upon their elimination of inner speech.

Say to them in substance: "Read this selection as fast as you can. While reading do not move your lips or tongue. Do not pronounce the words to yourself, as that will cause you to read more slowly than you otherwise would. I want to see how much you can read in ——[1] minutes. But do not skip anything, as I am going to ask you to tell me about the story you have read. Try to read faster to-day than you did yesterday."

See that the pupils have a pencil at hand and direct them to stop reading at once as soon as you say "stop." Direct them then to mark the end of the line which they are reading when told to stop. Pupils may now reproduce what they have read as indicated above. In a similar manner, reading and reproduction are to be continued until the end of the 30 minutes assigned. Have the pupils then report the number of pages and lines beyond the last full page which they read.

As part of your preparation for the exercise you will be expected to know the average number of words per line in the matter which is being read and the number of lines per page (if pages are broken by illustrations or for other reasons, special account of these pages will have to be taken). From the pupils' reports as to pages and lines read each day, estimate the number of words read that day and divide by the

[1] Number of minutes to be varied by the teacher, as two minutes for one reading stretch, three minutes for another, etc.

total number of minutes used in reading. This will give the number of words read per minute by each pupil. Each student should figure out his score, and should immediately enter it upon the chart, which will thus serve as a record of the pupil's daily progress in silent reading. The teacher is also requested to keep a diary in which she will daily record notes and observations concerning the progress of the experiment.

On May 1 and May 28, besides the record of the average number of words read per minute by each pupil, during the total reading time, a record of the average number of words read per minute by each pupil during each of the various reading periods constituting the total time devoted to reading on each of the above mentioned days should also be kept.

On May 2 and May 29, the pupils should be tested with the Courtis Silent Reading Tests. As soon as possible after the last Friday in May a copy (or the originals) of the individual charts, the class chart, and a record of results and observations should be mailed to the Bureau of Educational Research, University of Illinois, Urbana, Illinois.

It will be noticed that this method employs all the auxiliary devices, the time control, and the technique of Type I. The difference lies in the inclusion in the second method of the additional factor or principle — decreasing the vocalization. The two principles, practice in rapid silent reading and decrease of vocalization, are both fundamental in this latter Type. The stress is now placed upon the lessening of the inner speech, though emphasis upon rapid reading still remains. In order to determine the comparative efficacy of these

two factors in accelerating the rate, it was originally planned to exclude the latter principle and to construct this method directly upon the decreasing of the vocalization as the sole basic principle. Preliminary investigation showed, however, that the effort to lessen inner articulation was far more successful when the individual not only consciously endeavored to inhibit such movements but also read rapidly at the same time. The comfortable, leisurely rate of reading to which the average individual is accustomed seems particularly favorable to the arousal of the usual articulatory movements.

It was found that when to the conscious attempt at inhibition was joined rapid reading, the decrease of inner articulation was effected more promptly and more thoroughly. Apparently, these two factors are so closely interrelated that a mutual causal relationship exists between them. The exclusion of rapid reading from the training to decrease vocalization would have deprived the latter of one of its most effective aids. Accordingly, the basic position in the second method is shared coördinately by these two principles, which work hand-in-hand. The coördinate stress thus placed upon rapid reading while the subject is trying to check the articulatory movement is one of the important particulars which differentiates this type of training from that received by the two subjects in Gray's experiment which was discussed in Chapter III.

It will still be possible, moreover, to determine to

some extent the amount of influence exerted upon the acceleration of the rate by the decrease of vocalization. Since this latter factor is the only one possessed by Type II which is not also included in Type I, the difference in the amount of gain effected by these two Types can be largely attributed to the only factor not common to both — the conscious decrease of vocalization in silent reading.

CHAPTER VI

TYPE III. TRAINING IN PERCEPTION

The core of the reading complex is the process of perception. The movement of the eyes from pause to pause, their convergence and divergence in fixation, the numerous and varied play of the neural-muscular mechanism involved in the ocular adjustment to the printed symbols, are all subsidiary to the main process of perception. The latter constitutes the actual seeing or visualization of the printed words. The results of numerous investigations, as stated in the earlier chapters, have shown that the overwhelming bulk of the reading time, in fact from twelve-thirteenths to twenty-three twenty-fourths, is consumed by the fixation-pauses. The total reading time, therefore, may be said to be practically the number of the pauses multiplied by their average duration. But the number of pauses per line is dependent upon the size of the perceptual span — the wider the span the fewer the pauses, and *vice versa*. Hence a type of training that is to effect any appreciable economy in the reading time must, in some way or other, influence the perceptual process that occurs in the fixation-pause. The improvement may be

secured either by widening the visual span, causing fewer fixations, or by accelerating the perceptual process, thus lessening the duration of the fixation-pauses, or by a combination of both these results.

Peripheral Vision

Upon the fixation-pause, during which all vision or perception occurs, has been focused the attention of many investigators. The perception that occurs therein is of two kinds, foveal and peripheral. The area that can be grasped by foveal vision in any one fixation is relatively small. Only about five letters (61) will be "unequivocally clear" when the eyes are held quite stationary. The adjoining letters will not be so sharply defined, but will shade off gradually into a hazy outline, growing fainter and fainter as they recede from the foveal area. These letters are grasped only by peripheral vision. The area of peripheral vision is consequently much larger than that of clear vision. The number and duration of pauses per line and the speed of reading in general are thus seen to be conditioned to a considerable degree by the effective utilization of extra-foveal vision. The importance of this phase of the reading complex seems to have been rather generally overlooked. Practically no conscious attempt is made in the present teaching of reading in the schools to develop peripheral vision or to enlarge its areas. Reading which is wholly or chiefly dependent upon foveal vision will be slow and halting, marred

by too frequent pauses, which inhibit the development of a regular rhythmical swing of the eyes in traversing the printed line.

Dodge (61), who has analyzed the functioning of the various elements in the reading complex with marked acuteness, thus describes the work of extra-foveal vision:

"Sometimes the peripheral vision of words, when they are indistinctly seen in the hazy part of a line, is sufficient for reading. It is always useful, furnishing an important premonition of coming words and phrases, as well as a consciousness of the relation of the immediately fixated symbols to the larger groups of phrase and sentence. Without this premonition of coming words and the outlines of larger groups, the process of reading would be slow and difficult.

"In normal reading there is abundant evidence that the word forms, indistinctly seen in peripheral vision, begin the reading process well in advance of direct fixation and the consequent clearing up of the letters.

"It is this premonition of coming words and phrases, sentence breaks, and paragraphs, that determines the position of future fixations, and reduces the duration of individual fixations sometimes to pauses one-quarter the normal perception time. They are often less than the simple reaction time of the eye."

Not only is peripheral vision effective in decreasing the number and duration of the fixation-pauses per line and consequently accelerating the rate, but it is also instrumental in fostering and stimulating meaning premonitions, thereby improving comprehension as well. Hand in hand with the reaching out of percep-

tion beyond the immediate field of clear vision seems to go the reaching ahead of the assimilative factor beyond the meaning grasped in direct fixation to those dimly felt in the extra-foveal area. Meaning premonitions, made more numerous and more vigorous by the functioning of a wide peripheral vision, play an important rôle in the rapid interpretation of the printed page. Just as extra-foveal vision frequently suffices for the reading of a word without the agency of direct fixation, so meaning premonitions not infrequently carry the reader over many a word without the immediate apprehension of the word in direct fixation. This is evidenced by the fact that a person in reading a selection aloud in which the meaning premonitions stream thick and fast into his consciousness will unwittingly substitute a synonym for the word actually occurring in the passage.

Concerning the importance of these meaning premonitions, Dodge (61) says:

"Adequate premonitions are as conspicuously lacking in the stumbling reading of childhood as in our reading of a foreign language. Their development is a most important part of the training in rapid reading. The very rapid reader who makes two or three steps in a line can see no more distinctly than the plodder with ten. *His main advantage is in the way he grasps what he sees only indistinctly in the extra-fixational vision.*" (Italics inserted.)

The Type of Training which will be outlined in this chapter has aimed to develop the more generous utiliza-

tion of peripheral vision, and of its mental correlate — meaning premonitions. The direction to the pupils in the exposure exercises, requesting them to read the sentence "as a whole," allowing time sufficient for but a single fixation, was calculated to call the peripheral vision into play, while the suggestion to look up occasionally and tell "how much they saw ahead" and how much of the remaining meaning of the sentence they could give, was designed to develop meaning premonitions along with the extra-foveal vision.

Foveal Vision

However important a factor peripheral vision may be in developing rapid, effective reading, direct or foveal vision still constitutes the core of the perceptual process — perception *per se*. In the field of clear vision it is not a matter of conjectural interpretation or inferences from previously perceived premises, but a matter of direct fixation and immediate apprehension. The functioning of direct fixation in connection with extra-foveal vision, Dodge (61) thus describes:

"In adult reading the moment of actual fixation seems to be an incident somewhere in the middle of the reading process. Coming between the premonition and the after echo, its effect is to correct, to confirm, and to intensify the premonition. Psychologically its function is selective and definitive. It emphasizes the excitation of suitable residua and inhibits the misfits. The pedagogical importance of word forms is clear. It is possible that special training in peripheral vision would be worth while, but it is equally

evident that no training is adequate which does not provide for the corrective coöperation of direct fixation."

The Type of Training to be outlined in this chapter aims definitely at the enlarging of the perceptual span functioning in reading. The work in exposure exercises attacks this problem directly. It endeavors to widen the span of attention so as to grasp three, four, five, six, and even more words if possible, in a single fixation. C. T. Gray (19) showed that a marked increase in the visual span resulted in the case of two fourth grade subjects after training in perception by means of tachistoscopic exposures. In the case of the two sixth grade subjects, however, similar short exposure exercises did not seem to effect any appreciable widening of the perceptual span *as determined by the number of words grasped in a tachistoscopic exposure.* However, an examination of the data afforded by the photographic record of the eye-movements in the reading of one of the two subjects, B. R., taken before and after the training in perception, yields a rather striking result. The following is a statement of the record as reported by Gray (19).

TABLE VII. EYE-MOVEMENT RECORD OF B. R. BEFORE AND AFTER PRACTICE

	AVERAGE NO. OF PAUSES	AVERAGE LENGTH OF PAUSES	AVERAGE NO. REGRESSIVE MOVEMENTS
Before practice . . .	15.5	15.4	4.5
After practice . . .	6.1	12.6	1.2
After 3 months' interval	8.4		1.2

An examination of these records clearly demonstrates a striking enlargement of the perceptual span *which functions in actual reading.* This is evidenced by the reduction in the average number of pauses per line from 15.5 in the first reading to 6.1 in the reading after the practice in perception. This indicates that the size of the perceptual span was more than doubled, since its width bears an inverse proportion to the number of fixation-pauses per line. Even the average duration of the perceptual process in the fixation-pauses was decreased from 15.4 to 12.6, showing improvement in this phase of the process also. A notable decrease in the average number of regressive movements per line is likewise noticeable. B. R.'s rate of reading as determined by careful tests had increased from 1.0 word per second before the practice to 5.0 words per second after the training — an improvement of 400 per cent.

Consequently while B. R.'s span of attention showed no notable increase in grasping numbers of words exposed by a tachistoscope, it showed a striking enlargement in reading an actual context. In alluding to this point in Chapter III, the writer termed the latter the *relative span of attention,* the span which functions in reading a context material, in contradistinction to the *absolute* span which functions in tachistoscopic exposure work. Exercises of this latter character have shown that the perceptual span which they call into play, grasping, as it does, five and six words in a single fixation, is seldom fully utilized in ordinary reading where

the span rarely exceeds two or three words. Consequently, while the absolute span of perception may show no increase as a result of training in perception, the relative span which functions in ordinary reading may reveal a striking increase, as in the present instance. In other words, the perceptual span is *utilized more effectively* in reading. The point made here is that this is true not only of fourth-grade subjects, but also of older subjects, as B. R.'s case well illustrates. The eye-movement records of B. R. certainly lend no support to the tentative conclusion of Gray that training in perception, if it is to produce results, should come before the fourth grade. For the perceptual span as it functions, not in the grasping of isolated words or phrases, but as it is used in the reading of connected material, is the important factor. That this latter is susceptible to improvement has been clearly shown by the record of Gray's subject, B. R.

Relation of Speed of Reading to Types of Imagery

What is the effect of the different types of mental imagery upon the rate of reading? In other words, Is the reading rate largely conditioned by the mode of imaging? If so, what types are conducive to rapidity and what ones tend to retard? These are some of the interesting questions which have been touched upon in recent studies in the psychology of reading.

To the above queries W. A. Schmidt (7) gives no uncertain answer:

"Individuals of this (visual) type" says he, "are by nature rapid readers, other conditions being equal. Their speed is not due to scanning, however, for they have no occasion to resort to this, since there is almost no limit to the rate of visualization. The motor type, on the other hand, tends to represent the slowest readers, the dependence upon the physiological mechanism being in this case quite marked. The auditory type ranks between the two, the hearing of the words being in this case often quite vestigial. This type appears to be much more common than either of the other two types. Most of the evidence which the writer has been able to gather through interviews with a large number of individuals seems to support the conclusion that the auditory-motor type of reader can compete with the visual only when he is able to resort to scanning. There can be little doubt that rapid readers fall almost exclusively into these two classes — those on the one hand who are good visualizers and those on the other hand who have acquired the ability to gather meaning from the printed page without definitely reading all the words and sentences."

The above conclusion of Schmidt's appears to the writer to possess a certain amount of plausibility. It seems at least *a priori* logical to assume that reading which involves merely, or at least chiefly, visualization, requires less functioning of the physiological mechanism than the auditory or motor types with their more or less elaborate movement of the musculature of articulation. Involving a less elaborate functioning, visualization would seem to be a more direct and more rapid mode of reading. Schmidt appears to go rather far, however, in maintaining that "good readers fall almost exclusively

into two classes" — good visualizers and those able to scan; that the auditory or motor readers can compete with visualizers only when they resort to scanning.

In the first place, the data which throw any light upon the influence of the various types of imagery upon the reading rate are exceedingly meager. The scanty evidence that is available, however, does not seem to warrant so positive a statement as to the conditioning, determining influence of the mode of imaging upon reading rate. There are numerous instances of very rapid readers who are decidedly "*auditaires*" and "*motaires*" but who can compete very successfully with the visuals. Moreover, it is to be remembered that the audition may be of the faint, vestigial psychical character involving, according to the introspection of some psychologists, no movement whatsoever of the musculature of articulation. In the writer's judgment, it is in the latter factor — the elaborate functioning of the physiological mechanism of vocalization — that the retarding influence is largely to be located. If the latter be eliminated, a high rate of speed may be reached regardless of the type of imagery, as the results of the present investigation indicate.

"Most of the evidence which the writer has been able to gather through interviews" is mentioned by Schmidt as the data [1] from which he generalizes concerning the

[1] After the above had been written, the writer received a communication from Dr. Schmidt, in which the latter mentions Quantz's experiment as corroborative of his generalization. As the writer had already

conditioning influence of the various types of imagery upon the reading rate. A grave difficulty which confronted the writer in his endeavor to secure data on this point by questioning readers as to their mode of imaging and their reading rate was their inability in the overwhelming majority of cases to determine with anything approaching certainty what is their dominant type of imagery. Nor is that strange. For, practically all the recent investigations (62–67) of imagery types have shown that, as a general rule, individuals employ not a single, constant type, but many types of imagery. Netschajeff (68) has conclusively demonstrated the existence of such combinations of imagery types, for example, as the visual-motor, and the auditory-visual-motor. Indeed, even in a single type of mental work, individuals are found using now one, now another mode of imaging. There is a confusing complexity of modes of imaging in a single individual.

In view of this fact it is not surprising that an individual when interviewed can scarcely state offhand what is his precise type of imagery. Even when sub-

analyzed the results of Quantz's experiment in this chapter, it is felt that all of the essential data upon which Dr. Schmidt's conclusion rests have been considered. Dr. Schmidt also states that the adults whom he interviewed "were, for the most part, individuals who had studied psychology rather extensively. In consequence they were, as a rule, able to attempt (whether they succeeded is quite another question) to classify themselves as auditory, motor, or visual in type." In the writer's judgment, the attempt to classify oneself in regard to imagery type, without using any psychological test, is rather precarious. Dr. Schmidt has the gratitude of the writer for his additional information.

jected to psychological tests in the laboratory, the dominant type of imagery is not always established with certainty. Indeed, there is no single, psychological test that can be relied upon to discover with certainty the dominant mode of imaging in the case of a "mixed" type. It is in the latter case, moreover, that most individuals are found to belong.

Meumann (69) epitomizes the results of his own extensive investigations and those of other investigators when he states: "Investigation has shown, however, that the great majority of people belong not to pure, but to mixed or balanced ideational types. In these cases, we have a compromise between ideational type and sense-modality." Illustrating the complexity of modes of imaging in a single individual, he says: "For instance, the concrete visual type of ideation may coexist in any individual with verbal ideation of another source, — with vocal-motor or with verbal auditory imagery."

Consequently the question might well be raised as to the accuracy and the general value to be attached to information derived from interviews upon a question that is notoriously difficult to answer, even when fortified with the results of a psychological test, to say nothing about the case when it is answered offhand without such a basis for a reply.

The only express attempt, to the writer's knowledge, to attack the problem of the influence of imagery types upon reading rate was the experiment of Quantz (26)

at Wisconsin. Quantz sought to determine the relative influence of the visual and the aural bias upon the reading rate in three ways:

"(1) by testing the visual and auditory span; that is, the limit of power to repeat correctly words read or heard once; (2) by detection of differences between two variant readings of the same passage; (3) by the ability to reproduce the thoughts of two selections, one of which was read to the subject, the other read silently by him, *at the same time.*"

Whether any of these three tests actually determined the dominant type, or even the relative strength of the visual and auditory imagery in the individual, is very doubtful. Underlying the three methods employed by Quantz is the assumption that the capacity to grasp and remember or reproduce words presented orally or visually constitutes an index of the relative strength of the auditory or visual type of imagery. That words presented orally and reproduced in the same manner do not necessarily tap solely the auditory type of imagery is evident from the fact that there is always the possibility of transforming the auditory impression into another more favored type of imagery. The same is true of the possibility of transforming the visual impression into an auditory image. The existence of such a substitute mode of imaging, a "surrogate," or sort of vicarious functioning of imagery types, which has been experimentally demonstrated by Meumann, serves to render the fundamental assumption underlying Quantz's three tests very doubtful, and the con-

clusions based upon such tests, of similar questionable validity.

Indeed, Meumann (69) cites as an illustration of a process wherein substitutive imagery may be employed, practically the same task as Quantz's test of the span of prehension — "the limit of power to repeat correctly words read or heard once."

"Let us take," says Meumann, "the case of an individual who has read a list of words or to whom such a list has been dictated, with a view to having them reproduced immediately in vocal form. The mixed type is always able to adapt itself to this task. . . . In recalling auditory words immediately after hearing them, the visualizer may employ auditory images chiefly, but may make a secondary use of the visual imagery into which he has transformed the auditory material; but in recalling a conversation with a friend after a long interval, . . . he has recourse chiefly to visual images of expressions employed by his friend during the conversation. The individual who belongs to a pure type, on the other hand, endeavors in immediate retention to transform into his own favored imagery the sensory impressions which he receives."

The results obtained from the three tests applied by Quantz are by no means uniform. The evidence from the first test (span of prehension) Quantz construes to indicate "a gradual increase in the rate of reading as the subject moves away from the auditory type and toward the visual." The results of the second test (detection of differences) are just the reverse, showing that the auditory type is decidedly more conducive to rapidity in reading than the visual type; while the

third test (comparison by simultaneous processes) seems to show a correlation between eye-mindedness and rapid reading. The conflicting character of the results obtained tends strongly to corroborate the writer's conclusion that not one of Quantz's three tests is really capable of determining whether the subject was dominantly of the visual or of the auditory type. Not having determined that first essential fact for a comparison of the relative advantage of the visual or auditory bias upon the reading rate, conclusions based upon correlations of reading rate with prehension span or similar exercises are quite lacking in validity. But even if it were assumed that the imagery types were established with precision, a conclusion as to the decided advantage of the visual over the auditory would scarcely be warranted in view of the conflicting character of the results obtained.

Thus the results — meager and conflicting as they are — of the only direct experimental investigation of this problem would hardly seem to support so positive a conclusion as Schmidt's that "the auditory-motor type of reader can compete with the visual only when he is able to resort to scanning."

Meumann does not treat specifically of the effect of the imagery types upon rate of reading, but he does discuss their influence upon rate of associative learning. In this connection, he states that "the auditory-motor individual always seems to possess a less reliable, but a *more rapid* memory" than the individual of the visual

type. The auditory-motor type seems to function more rapidly in associative learning.

To the question then: Is the visual or the auditory bias more conducive to rapidity in reading, no positive, definite answer, in the writer's judgment, can as yet be given. The paucity of experimental evidence on this point is such as to render any conclusion but tentative and highly conjectural. The conclusion of Schmidt's ranking the visual type as the most advantageous, the motor type the least, and the auditory as intermediate, while theoretically very plausible, is as yet without sufficient experimental corroboration. But the meager evidence that does exist warrants no such fatalistic attitude as Schmidt's concerning the all-powerful, conditioning influence of the imagery type upon reading rate. Rapid readers have been found among all types of imagery. In the present study the vast increase in speed reported of all the experimental pupils in certain grades, — in which there were beyond doubt different types of imagery — indicates that marked improvement in rate may be secured regardless of the pupil's mode of imaging.

Training in Perception

The third type of training has been based directly upon the findings of the psychological laboratory as to the functioning of the eyes during reading, showing the crucial importance of developing and widening the perceptual span, or at least of making more effective

use of it in reading, of decreasing the duration of the fixation-pauses, and of cultivating a regular, rhythmical swing of the eyes in the inter-fixation movements. The method was worked out carefully in its entirety. It was found, however, that none of the present types of tachistoscope could be used satisfactorily for groups of pupils. In class exercises the word or phrase exposed should be legible equally (or approximately) to every pupil. An apparatus which would expose cards, containing words and phrases of varying length, suitably to a whole class, for intervals ranging from about one-twelfth of a second to two seconds, and which would, moreover, be easily manipulated by the teacher was found necessary if the work was to be done with the scientific accuracy necessary for the purposes of this experiment.

Such an instrument could not be devised in the time at the writer's disposal before the launching of the experiment on the scheduled date. C. H. Stoelting of Chicago, with whom the plans were carefully discussed, has given the writer the assurance that an instrument of this type suitable for classroom purposes can be devised. Superintendent Taylor of Oregon has also worked out plans for its construction. The proper instrument may be available shortly. Though this type of training was not actually applied in the present investigation because of the lack of proper technical apparatus, it is thought that the presentation of an outline of the method may be worth while. This would

seem to be so in view of the probable appearance of the necessary mechanical device in the near future and because there is considerable evidence which points to a method of this kind as capable of greatly accelerating the reading rate. It is the hope of the promoters of this experiment to submit this type of training to an actual test when the necessary mechanical facilities are at hand.

STATEMENT OF

TYPE III. TRAINING IN RAPIDITY OF READING BY MEANS OF PERCEPTION CARDS

The cards used should be four inches wide and of varying lengths to contain words, phrases, or sentences.

The use of these cards is analogous to that of the exposure of material in laboratory work by means of an exposure apparatus or tachistoscope. In both cases, the subject is required to perceive the material exposed in as short a time as possible. There is experimental evidence tending to show that the amount of verbal material which a person can perceive in a given time can be increased — in other words, that perception may be improved. Probably it is not true that perception as a native endowment may be improved, but the method of using the native endowment — *i.e.* the performance, — is susceptible of extensive improvement.

The rate at which children can perceive words, phrases, and sentences has a rather obvious bearing on their speed of reading. Reading consists of a successive series of perceptions. The eye does not move regularly along the printed line but jumps from one point to another, pausing at each point. It is during the pause that perception takes place. In a very real sense, therefore, the printed line consists of a series of flashes or exposures.

To improve the rate of reading, therefore, we need to reduce the number of exposures per line by increasing the amount of material presented at each exposure and to shorten the length of each exposure. This suggests that we may directly attack the problem of increasing the speed of reading (*a*) by training the pupil to "see more at a glance," and (*b*) by training him to see the material more quickly.

Obviously, we cannot control either the amount seen at a glance or the time of the exposure by using the printed page. If, however, we can present, by means of perception cards, portions of the text in the form of words, phrases, and sentences, we may gradually lengthen the amount of material on the cards as the pupil's ability to perceive it increases, and we may also reduce the time during which it is placed in view.

This is the fundamental idea in the method we are now proposing.

The reading period should be 30 minutes long. Half the period should be devoted to the presentation of material by means of the perception cards. The remainder of the period should be devoted to reading from the book in which, as far as possible, the same words, phrases, and sentences are met.

During the first half of the period the attempt should always be to make the period of exposure of the cards as short as possible. Day by day the length of the material should be increased. In fact, either one of two methods may be used and both should be used during the course of the experiment: (*a*) the time of exposure may be kept constant and the length of the material may be increased; (*b*) the length of the material may be kept constant and the time decreased.

In order to obviate as far as possible any interference with the perceptive processes due to the presence of unfamiliar

words, the teacher should drill on single words which she has reason to believe are unknown to a number of the children. These words may be placed on the board or presented in the usual manner.

It is desirable that the material be printed on the perception cards rather than written. For this purpose a stamping outfit should be provided. It is recognized also that a great deal of work will be involved in preparation for the class period. The promoters of the experiment are willing to coöperate with the teachers in securing help for this work.

The second part of the period should be devoted to a conscious attempt on the part of the teacher to secure a transfer of the perception processes from the cards to the printed page. When a phrase or sentence is encountered, children should be told that the phrase or sentence is to be "seen all together." Such directions as "do not look at every word," "see it as a whole," "read it all together," may serve to carry over from the work with the cards to the work in the book something of the same attitude.

This method should continue from the first Monday in April to the last Friday in May. An accurate record of the progress of the pupils should be kept so that the increase in perceptual span and in rapidity of perception may be noted. A simple form will be provided for this purpose. The teacher is also requested to keep a diary in which she will daily record notes and observations concerning the progress of the experiment.

The teacher should select easy reading material for use during this experiment in order that the difficulty due to unfamiliar words may be reduced. In all the reading other than that done in the half hours set aside for the experiment, the teacher should seek by admonition, encouragement, and example to inculcate the idea of increasing the span of perception — *e.g.* reading by phrases — and to decrease the time

required to "look at" a group of words. An interesting exercise may be devised in which pupils may be requested to glance at the first words of a paragraph and immediately raise their eyes, whereupon they may tell "how much they saw."

The following suggestions are offered indicating the nature of the directions to be given to the pupils. Literal adherence to them is not requested. Point out the advantage of a rapid rate of reading. Try to get them to see this in terms of an addition to their own interests and pleasure. Say to them in substance: "I shall show you some cards containing words, phrases, and sentences. They will be shown for only a fraction of a second. So you will have to read them very quickly, with a single glance of the eyes. Try to read all that is printed on each card. You will have to pay very close attention when I show you the card, as otherwise you will not be able to read all that is on the card. This practice in reading a number of words at a glance will help you to read more rapidly. Try to do better than you did yesterday."

Spend about 15 minutes in perception card training. After each exposure ask some of the pupils what was printed on the card. Toward the end of the training in perception, have all the pupils reproduce in writing what was on each of the five last cards exposed. The percentage of words correctly reproduced will constitute the pupil's score in perception. State the total number of words exposed on the five cards and it will then be easy for each pupil to figure out his own score. Direct each pupil to enter his score immediately upon the chart that each pupil will keep for that purpose.

The second half of the period should now be devoted to rapid silent reading. The pupils should be encouraged to carry over the habit of "seeing many words at a glance" gained by their training in perception, into the actual work

of silent reading. They should be directed to "run their eye across a line of words" as rapidly as they can, consistently of course, with an understanding of what they see. Throughout this reading period there should be a conscious effort to utilize the habit acquired through training in perception, by perceiving several words at each fixation, instead of but a single word. This should result in an increased rate of speed in silent reading.

Say to the pupils in substance: "Read this selection as fast as you can. I want to see how much you can read in ——[1] minutes. Try to see as much as you can read in a single glance, running your eyes rapidly across the lines. A fast, regular, rhythmical movement of the eyes will help you to read rapidly. But remember that I am going to ask you to tell me about the matter you have read, so do not skip anything. Try to read faster to-day than you did yesterday."

See that the pupils have a pencil at hand and direct them to stop reading at once as soon as you say "stop." Direct them then to mark the end of the line which they are reading when told to stop. Pupils may now reproduce what they have read. Reproduction should consist both of free paraphrase — orally, or in writing — and of answers to specific questions based on the text. The length of the reading period and of the reproduction period should vary with the grade of the pupils and with the subject matter. In general, however, the reproduction should not occupy more than one-quarter of the total time allowed for the exercise. Reading and reproduction are to be continued till the end of the 15 minutes assigned. Have the pupils then report the number of pages and lines beyond the last full page which they read.

As part of your preparation for the exercise you will be expected to know the average number of words per line in the

[1] Number of minutes, say two, three, or four, to be determined by the teacher.

matter which is being read and the number of lines per page (if pages are broken by illustrations or for other reasons, special account of these pages will have to be taken). From the pupils' reports as to pages and lines read on this and subsequent assignments for the day, estimate the number of words read that day and divide by the total number of minutes used in reading. This will give the number of words read per minute by each pupil. Each student should figure out his own score and should enter it immediately on the chart on which he has already written his perception score. This chart will thus serve as a record of the pupil's daily progress. It is also suggested that a complete chart of the daily class performance might be conspicuously displayed in the classroom.

On May 1 and May 28, besides the record of the average number of words read per minute by each pupil during the total reading time, a record of the average number of words read per minute by each pupil during each of the various reading periods, constituting the total time devoted to reading on each of the above mentioned days, should also be kept.

On May 2 and May 29, the pupils should be tested with the Courtis Silent Reading Tests Forms II and III. As soon as possible after the last Friday in May, a copy (or the originals) of the individual charts, the class chart, and a record of results and observations should be mailed to the Bureau of Educational Research, University of Illinois, Urbana, Illinois.

CHAPTER VII

STATEMENT OF PROCEDURE

After having devised the preceding types of training, the next step was to apply them to a sufficiently large number of pupils in the different grades of the elementary school. This would serve to test the efficacy of the factors included therein. Although these factors had been selected because psychological experimentation, pedagogical investigations, and *a priori* evidence had suggested their special significance in accelerating the reading rate, their value as constituents of an organized and *usable* method of training to increase speed could be determined only by subjecting these methods to an actual test under ordinary schoolroom conditions.

Fortunately, at this time the newly established Bureau of Educational Research at the University of Illinois, as one phase of its activities in stimulating the interest of the schools of the state in the scientific study of education, had secured the names of the superintendents and teachers who were interested in the problem of reading. From this number and from others who graciously offered to participate in this study, the following selection was made. It comprises 40 grades in 20 schools located in nine cities in Illinois.

City	School	Grade	Teacher
Bloomington, Ill.	St. Mary's	5	Sister Bernadine
Bloomington, .	St. Mary's	6	Sister Mary
Chicago, . . .	Goodrich	4	Clara E. Klass
Chicago, . . .	Goodrich	5	Virginia Lee
Chicago, . . .	Hendricks	5	Rose McComskey
Chicago, . . .	Hendricks	7	Bridget McElherne
Chicago, . . .	Hendricks	8	Ida M. Stodder
Chicago, . . .	Hendricks	4	Gertrude Tighe
Chicago, . . .	Hendricks	5	Ruth Wimmer
Chicago, . . .	Manierre	8	Margaret Dougherty
Chicago, . . .	Manierre	5	Mrs. Nellie Hahn
LaSalle . . .	Lincoln	7	Mary Y. Duncan
LaSalle, . . .	Lincoln	4	Margaret Flanagan
LaSalle, . . .	Jefferson	7	Elizabeth Hanley
LaSalle, . . .	Jefferson	4	Marcella Mullin
Oregon, . . .	Oregon	7	Elizabeth Joiner
Oregon, . . .	Oregon	4	Marion Metzger
Rushville, . . .	Webster	6	Minnie B. Thomas
Rushville, . . .	Webster	3	Dena Tutt
Streator, . . .	Garfield	3	Minnie Shinn
Streator, . . .	Grant	6	Lulu Leland
Streator, . . .	Grant	3	Frances C. Linskey
Streator, . . .	Grant	8	J. E. Mather
Streator, . . .	Greeley	6	Rose M. Boyd
Streator, . . .	Greeley	7	Gertrude Scanlan
Streator, . . .	Lincoln	4	Lalla Roberts
Streator, . . .	Plumb	5	Lillian SeCora
Streator, . . .	Sherman	6	Ruth Kelley
Argo, ...	Argo	4	Marie McCarthy
Argo, ...	Argo	5	Mary L. McGuire
Sycamore, . . .	Central	4	Hazel B. Mason
Sycamore, . . .	Central	7	Florence Wolhensack
Taylorville, . .	East	4	Mrs. Agnes Abrams
Taylorville, . .	East	7	Leonora Drennen
Taylorville, . .	Hewitt	7	Maude Law
Taylorville, . .	Hewitt	4	Bessie Leigh
Taylorville, . .	Oak St.	4	Leona Peek
Taylorville, . .	Oak St.	7	Florence Layzell
Taylorville, . .	West	4	Mrs. Laura Huff
Taylorville, . .	West	7	Mrs. L. P. Anderson

Among the number is a parochial school, St. Mary's in Bloomington; the rest are public schools. The cities are fairly well scattered throughout the state. They range from the metropolis Chicago, down to the smaller cities of the state, such as Sycamore. The constituency of these 20 different schools largely reflects the cosmopolitan character of our school population. The pupils of the Goodrich School in Chicago are almost exclusively of Italian parentage; those in the Argo School are dominantly of Polish extraction. The offspring of Bohemians, Slavs, Austrians, and Hungarians are found in goodly numbers in the Streator schools; while children of native-born Americans predominate in the remaining schools. The subjects of this experiment were drawn, moreover, from practically every social strata of our heterogeneous population. This wide range in the character of the subjects would seem to render any appreciable gains in reading rate all the more interesting and significant. It would give to them a broader basis, and would illustrate the wide applicability of the methods of training to different types of subjects.

The training was extended throughout grades three to eight, inclusive. Since reading in the primary grades is so largely devoted to the mastery of the mechanics of reading — the distinguishing of the different letter-forms, their phonetic properties taken singly and in various combinations, and the recognition of simple word-forms, — it was not practicable to apply the

methods to the first and second grades. Indeed, in the writer's judgment, it is not possible to devise a type of training which is suitable alike to pupils in the first grade and to those in the eighth. The former are taken up almost entirely with the mechanics of reading, the latter have passed that stage completely. From the third grade on, however, the method is applicable since the formation of habits of rapid efficient silent reading becomes in these grades a matter of paramount importance.

Length of Training

The total period of training extended from April 8, 1919, to May 29, 1919 — a period of 39 school days. On April 8, May 2, and May 29, the reading period was devoted to the administration of the Courtis Silent Reading Tests. This left 36 school days in which the entire reading period of 30 minutes was devoted to the types of training. After 18 days of training, Form II of the Courtis Silent Reading Test was administered to ascertain how much improvement in speed and comprehension was effected in the first half of the training period, and how much in the latter half. The tests were also given to the control groups at the same time in order to secure a check for each half of the training period. In many of the schools, the period of 39 school days from April 8 to May 29 was interrupted by an occasional free day, or vacation periods of one kind or another. In every such case the date set for the

administration of the final Courtis Test was extended beyond May 29, so that the uniform number of reading periods might be devoted to the training.

Method of Control

In order to determine how much of the increase in speed and comprehension could justly be attributed to the particular type of training which the pupils received and not to their regular school work, each of the 40 classes was divided into two groups, approximately equal in rate of reading. The obtaining of a group whose aggregate ability in the particular activity that is being investigated is approximately equal to the aggregate ability of the experimental group is the ordinary method of "control" in experimentation of this character. An attempt was made in the present investigation to secure in addition a more refined type of control. Besides dividing the class into two groups, the sums of whose aggregate scores were approximately equal, the class was further subdivided into pairs of pupils of approximately equal speed in reading. One member of each of the pairs was placed in the experimental group, the other in the control group. This afforded a control not only for the experimental group as a whole, but also for each individual member in the group.

The advantages of the method of individual control are unmistakable. Chief among them is the securing of a basis of comparison which rests directly and inti-

mately upon the detailed specific facts rather than upon specious statistical group totals and averages. The equality between the constituent members of the two groups apparently reflected in the equality of the group totals is oftentimes more apparent than real. Though the totals of two groups may be approximately equal, the individual members in the two groups may not be at all comparable.

The following case serves to illustrate the application of this point in connection with the method of control in the present study. Before receiving instructions as to the method of procedure, a principal had contemplated dividing his class into four sections, ranging from the highest to the lowest in reading rate. The sum of the scores of the upper and lower quartiles would be approximately equal to the sum of the scores of the two middle sections. The former were intended to serve as the control group for the latter. Though the total number of points scored by each group would be approximately equal, the absolute lack of equality in the scores of all the individual members of the experimental group with the scores of the individual pupils in the control group, would be not less real. Consequently, a common basis of comparison between the individual members of the two groups would be utterly lacking. The equality between the individual members which the group totals would apparently reflect would be a statistical fiction, *sine fundamento in re.*

The method of individual control serves, moreover,

to eliminate the vexing question, How are improvements in different levels of ability to be compared? — a question that is always with us in the loose, slipshod method of group control. Take the case already cited of the upper and lower quartiles serving as the control group for the experimental section consisting of the two middle quartiles. The members of the lower quartiles have open to them a much greater room for possible improvement before reaching either the standard rates or the highest physiological limit, than say the pupils of the second quartile. Is an increase of 50 words per minute in speed to be evaluated no more highly in the latter than in the former? If it should receive a higher proportional credit, what will be the correct proportion? These are some of the questions which, though not frequently expressly raised by investigators, and less frequently answered, are nevertheless always implicit in the method of group control.

To obviate them and to secure a more refined type of checking device — one that is based more directly and intimately upon the detailed facts in the case — the method of individual control has been used in the present investigation. It has cost much in the way of additional pains, time, and labor. The writer believes, however, that the more incisive and clear-cut basis of comparison which resulted was worth the price.

The following extracts from a circular letter sent to all schools participating will show the method employed by the teachers in securing both the group and

the individual control. The explicit character of the directions indicates the pains taken to insure uniformity of procedure in this important phase of the experiment.

Directions for Division of Class

"We are mailing you —— [1] copies of the Courtis Silent Reading Test. Kindly have the teachers you have selected administer these tests to their pupils on Friday, April 4.

"On the basis of the results of these tests have them divide each of the above mentioned grades into two groups of approximately equal speed in silent reading. In this division only the score in speed (or words read) should be regarded. The score in comprehension (questions answered) should be marked, but should not be taken into consideration in the question of dividing the grade into two groups. These groups should be built up as follows:

ILLUSTRATION FOR CLASS OF TWENTY

	GROUP A	GROUP B
Pair 1	190	188
Pair 2	185	185
Pair 3	179	180
Pair 9	68	67
Pair 10	50	55
Total	1452	1449

"Rank the pupils in each entire class on the basis of speed from the best to the poorest. Number them in order, beginning with the best (1, 2, 3, etc.), assigning them a rank. Put all the odd numbered children in Group A, and all the even numbered children in Group B. You will then have

[1] Number inserted.

two groups of approximately the same scores. Write in the scores of the pupils. The tendency will be for the scores of Group A to run higher. Now make minor adjustments by shifting pupils from one group to the other until you have (*a*) pairs of pupils of as nearly the same score as possible, and (*b*) as a result, the total group scores nearly the same.

"Group A will be called the Experimental Group and Group B the Control Group. This means that the method of instructions set forth in the inclosed directions is to be followed for Group A *only*, and that Group B is to be taught in the usual way. If there is an odd number of pupils in a class, put the odd pupil in Group A.

"After having scored the papers and used them to divide the classes into two groups, kindly send the papers to us for purposes of diagnosis and further study. Also kindly inclose the test blanks which were not used. Ship by express collect.

"We are also sending you a sample form of chart for the individual pupil, and a sufficient number of sheets, so that each pupil can make his own individual chart under the direction of the teacher. It is suggested that this may be done in a drawing or arithmetic period on Friday, April 4. Actual work on the reading project should begin on Tuesday, April 8. The testing and division of the classes into two groups, as well as the preparation of charts, should therefore be finished before Tuesday, April 8."

In the Courtis Silent Reading Test, the results of the performance are divided into the score for speed and the score for comprehension. Unlike the Kansas Silent Reading Test, there is no compound score serving as the single index of the efficiency of the combined qualities of speed and comprehension. In the above

set of directions, it will be noticed that the score in speed, and not the score in comprehension, constituted the basis for the division of the class into groups and pairs. This was because the investigator, being primarily interested in the development of speed, was thereby enabled to compare the progress of the two groups in this particular phase of reading more satisfactorily than if either the score for comprehension or the score for the combined qualities of speed and comprehension were used as the basis for the division.

The Individual Chart

Every pupil in the experimental groups was requested to keep an individual chart. Since uniformity in the computation of the chart was necessary in order that the graphs of the pupils in the different grades might be readily comparable, a set of directions was sent to every teacher to insure uniformity of procedure on the part of the pupils. As many of the pupils were in the third and fourth grades, and had had no previous experience in graphing, it was found necessary to make the directions very explicit and detailed. Besides the following set of directions, a sample copy of the individual chart was sent to each teacher.

Directions to Teachers for Making Individual Charts

On Friday, April 4, have each child make a blank form like the sample submitted. On account of the capacity of the

sheet, the diagram is arranged so as to record the number of words per *half*-minute.

Observe that the dates during which the special instruction takes place are arranged from left to right along the base line and that the speed in words per half-minute is expressed along the vertical line. The idea is this: If a child reads on a given day at an average speed of 220 words per minute, divide 220 by 2, giving 110 as the average number of words per half-minute. Suppose that this record was made by the pupil in question on April 8. Have the pupil put a dot above the date and at 110. He will make no other entry on that day. Suppose, however, that on the next day (April 9) he reads at the rate of 240 words per minute, or 120 words per half-minute. He will then put a dot over April 9 and opposite 120, at the same time drawing a line between the dot he entered the day before and the one he has just entered.

On subsequent days he will record his speed in the same way, each time putting a dot over the date and opposite the number of words he read per half-minute, and drawing a line to connect this dot with the last one he has made. If the average number of words per half-minute for a given child on a certain day lies between two numbers written at the left side of the diagram, let him estimate how high to place the dot. Suppose, for example, that he has read 268 words per minute, or 134 words per half-minute. The dot will then be not quite halfway up from 130 to 140.

It has been found not only that children rather readily understand the making of such a chart but that they enjoy watching their curves grow. Of course, the interest lies in seeing the extent to which the slopes upward indicate improvement.

If there is a break in the record — due, for example, to the absence of a child — the dot should be entered above the date of the day when the record is resumed, and a line should be

drawn from the last dot to the one just made. This line will cross over the intervening day or days, and to indicate that a break has occurred, the *line should be dotted.*

Observe that two school days are omitted along the base line, namely, May 2 and May 29. These are the days on which you are requested to test your pupils with the Courtis Silent Reading Tests. You will not be expected to conduct a reading recitation in either Group A or Group B on those days.

It is suggested that added interest may be given to the work if you have a class chart on which you will enter the average speeds of reading for the class in precisely the same way that the children will enter their individual results. If you have sufficient blackboard space, a chart may be drawn on the board. A large sheet of mounting paper will, however, be fully as satisfactory.

Reading Conference

Despite the pains taken to formulate directions that would guide the teachers in every important step in the procedure, it was recognized that differences in the application of the method by the various teachers might still result. These differences might mar or at least weaken the accuracy of the conclusions that would be drawn from the study. If the teachers could witness the concrete application of the method, and the mode of computation, besides having an opportunity to present orally any difficulties which occurred to them, and have them cleared away, a greater guarantee for uniformity of procedure would be secured. Accordingly, a representative of each school system[1] partici-

[1] There was no delegate from Bloomington. The writer went there personally to explain the method, its application, etc., to the teachers.

pating in the experiment was invited to attend a conference at the University of Illinois, where the method was demonstrated and explained in detail.

The conference lasted an entire day. In order that all the teachers might benefit from the conference, a stenographic report of the demonstration class and of the discussions by the delegates and the promoters of the experiment was sent to every teacher. This served to supplement the report which each delegate brought back to her colleagues. The following extracts from the circularized report of the conference will convey some idea as to the nature of the meeting and the points discussed.

"On Saturday, April 12, representatives of the various school systems engaged in the Silent Reading Project assembled for a conference at the University of Illinois. The following is the list of those present:

Mr. D. E. McCraken	Principal	Manierre School	Chicago
Mr. F. R. Nichols	Principal	Hendricks School	Chicago
Miss Clara F. Klass	Teacher 4	Goodrich School	Chicago
Miss M. D. Wheaton,	Teacher 3	Goodrich School	Chicago
Mr. C. B. Smith	Superintendent		Rushville
Mr. D. L. O'Sullivan	Principal		Argo
Mr. F. G. Taylor	Superintendent		Oregon
Miss Mary T. Duncan	Principal		LaSalle
Miss F. C. Lenskey	Teacher 3	Grant School	Streator
Miss Rose M. Boyd	Teacher 6	Greeley School	Streator
Miss Maude Law	Teacher 7	Hewitt School	Taylorville
Miss Hazel B. Mason	Teacher 4	Central School	Sycamore

"Miss Davis brought her fifth-grade class from the Lincoln School, Champaign, and demonstrated the method of training the pupils in rapid silent reading. The total time allowed

for the period was 30 minutes. The teacher secured seven reading stretches consisting of 3, 4, 2, 4, 3, 3, 3 minute periods, making a total of 22 minutes spent in actual reading. The instructions, questions, and answers on the matter read occupied only eight minutes."

There was considerable discussion by the delegates as to the method of procedure in computing the average number of words per minute and of graphing. The following extracts from the conference report will serve as a résumé of the chief points discussed and of the conclusions finally agreed upon.

"1. There was a discussion as to the expediency of computing the number of words read per minute from only one of the reading stretches of say, two or three minutes' duration, or of computing the average number of words read per minute from the sum total of all the reading stretches during the 30-minute period. The representatives decided to adopt the latter method. Consequently, if there have been eight reading stretches of two and three minutes' duration, so that, say, the sum of 20 minutes was spent in actual reading, it would mean that the total number of words read, say 5000, is to be divided by 20, giving 250 as the average number of words read per minute.

"2. The question as to whether or not the teacher should take down the number of the page reached by the pupil after each reading stretch or merely at the end of the total reading time was discussed at length. It was agreed to leave that point to the discretion of each teacher — whichever method she found the more effective she should be free to adopt. Miss Davis reported that after trying it both ways, she preferred to take the number of the page reached by each pupil only at the end of the period, as this allowed

more time to be spent in actual reading than was possible under the other method.

"3. In making the class chart, the delegates decided to use the median rather than the average. The median is simply the score of the pupil middlemost in the order of rank. In a class of 21 pupils, the score of the 11th pupil would constitute the median for the class. If there are an even number of pupils, the median is the score midway between the scores of the *two* middle pupils. In a class of 20, therefore, the sum of the scores of the tenth and eleventh pupils when divided by 2 gives the median.

"4. Suitable reading material for the different grades was discussed. It is important that the material chosen be not too difficult for the grade. Easy material is to be preferred to make possible the setting up of habits of rapid eye-movements."

Inasmuch as the pupils in the experimental groups were covering two, three, four times the usual amount of reading matter, the problem of supplying them with sufficient suitable material soon became a pressing one. The reading material that was on hand for the particular grade was exhausted by the experimental pupils in the course of a few weeks' practice. A list of selections suitable for the different grades was submitted by the delegates. This list was incorporated into the Report of the Reading Conference. In addition to this, Mr. James F. Hosic of the Chicago Normal School kindly selected a list of books especially suitable for the purposes of the experiment from a much larger number which he had prepared for use in certain Chicago schools designated for the time as "English

centers." A copy of this list was also sent to each teacher. Both of these lists will be found in the appendix to this study.

The Work Curve for One Reading Period

The reading period is divided into five, six, or seven stretches of two, three, and occasionally of four minutes' duration. The method of computation which the teachers decided to adopt secures the average number of words read per minute by each pupil during the total reading period. It does not determine, however, the average number of words read per minute during each of the reading stretches. It left unanswered the questions: In which of the stretches do the pupils obtain the highest speed? Does the intensive nature of the work cause a marked decline towards the end of the period? Does the curve for this type of activity bear much similarity to the work curve described by Offner (70), Rivers and Kraepelin (71), and others? To throw some light upon these interesting queries, a number of teachers in different grades were requested to secure a record of the average number of words read by each pupil during each of the various stretches on a particular day.

At the conclusion of the experiment, the test papers, the individual graph, the class charts, teachers' notes and observations were sent to the writer. A careful examination of the scoring of the Courtis Tests, especially in computing the index of comprehension,

revealed too large a percentage of error. Most of the computation of the scores had been done by the pupils, as Courtis suggests. For the sake of accuracy, all of the Courtis tests, including the three forms I, II, and III, were reëxamined and rescored by trained clerks under the writer's supervision. The tremendous amount of labor involved in recorrecting approximately 4000 test papers, determining the score in speed per minute for each one, computing the index of comprehension, making the necessary readjustments in the matching of the pairs of pupils, has been chiefly responsible for preventing the publication of this investigation at an earlier date.

CHAPTER VIII

STATEMENT OF RESULTS

The chief instrument used in this investigation to measure the growth in speed of reading was the Courtis Silent Reading Test No. 2. There are three different forms of this test, each of which is approximately equal in difficulty. The triplicate character of the test made it possible to test the pupils at the beginning, middle, and end of the training with the same kind of measuring device, and yet avoid the complicating factor of special familiarity with the specific subject matter of the test. The uniform character of the three forms of the test likewise renders feasible the comparison of the scores made in the beginning with the scores made at the middle and at the end of the training. The employment of different standardized tests on the two latter occasions would have destroyed this uniformity in the character of the measuring device and would have rendered such comparison hazardous.

Another advantage arising from the selection of the Courtis test is that its division into two parts — a measurement of rate and a measurement of comprehension — enables the investigator to ascertain the

speed of a pupil's reading as distinct from his comprehension. It disentangles these two factors and weighs them separately.

The Courtis Test is not, however, without its shortcomings. While it is helpful to know the score of the two factors — speed and comprehension — separately, it is not less helpful to know the score for these two factors when functioning conjointly on the same passage. This the Courtis Test through its score of rate and index of comprehension does not determine. At the time the score for rate of reading is determined, there is no measure taken of the comprehension that accompanied such reading. Herein lies the chief weakness of the Courtis Test.

By supplementing the index of comprehension — which reflects only the proportion of the correct to the incorrect answers, independently of the absolute number attempted — by the number of correct answers, this difficulty is in a large measure obviated. For the number of correct answers reflects not only the ability to comprehend the matter but the speed with which the pupil reads and comprehends.

According to the method of computing the index of comprehension as stated by Courtis, a pupil who attempts only five questions in the five minutes allowed and answers them correctly secures a mark of 100 per cent in comprehension. So likewise does the pupil who attempts 60 questions and answers them all correctly receive a mark of 100 per cent. Yet it is obvious

that there is a great difference in the performance of the two pupils — the latter is much superior. This difference is not reflected in Courtis' Index of Comprehension. Accordingly, in this investigation, the number of questions correctly answered was used as a score of the pupil's comprehension to supplement Courtis' Index, and to express actual differences in the performances of the pupils — differences in levels of achievement. This device enables one to determine whether the training was effective in increasing the rate of reading when the comprehension is employed conjointly and is being tested simultaneously. In fact, in many respects the number of questions correctly answered is a better measure of the efficiency of comprehension on the part of the reader than the index as devised by Courtis.

Standardized tests are all open to the criticism that they test but one performance of the subject. The performance of the pupil on the particular day on which he was tested may have been normal or it may not have been. Due to any one of a thousand causes which affect the variability of the functioning of a human personality, the subject may not have been true to form on that particular occasion; he may not have been able to display his highest ability. In other words, the test gives but one sampling of a variable functioning. Whether that particular sampling really represents the pupil's ability is a matter which can be determined only by repeated testing.

In the present investigation the attempt has been

made to obtain a picture of the pupil's daily growth in speed of reading by securing a record of his daily performance for a period of two school months. This was accomplished by means of the individual chart, which showed the average number of words read per minute by each pupil on each of the 36 days of the training period. It represents the results of 36 measurements of rate. As such, it has the advantage of a certain degree of reliability which accrues from repeated testing. The disturbing factors of variability are practically equalized in such a large number of measurements.

While the individual graph has the advantage of a much larger number of measurements over the standardized test, it is inferior to the latter in the unstandardized character of the subject matter on which the record was made. The individual chart represents rates of speed in reading the ordinary type of material which is found in the graded readers. In the majority of cases it is safe to say that the matter is fairly well adapted to the reading capacity of the pupils. But it is not uniform for all the pupils. One fourth grade, for example, uses one reader, another fourth grade uses a different one. This is true for almost all the grades. While all the reading books for one grade may be on the same general level, there are doubtless minor differences in degree of difficulty which make the record secured on one book not strictly comparable with the records secured on another reading book. In the

Courtis Silent Reading Test, on the other hand, the subject matter is absolutely uniform for all the pupils.

By using a fairly large number of different graded readers, as the pupils did in this experiment, the scores may be said to represent the rates on the average type of reading material for the particular grade. It is true that in any one class the average rate of speed would fluctuate somewhat on account of differences in degree of difficulty in different selections in the same reader, and also on account of changing readers. The large amount of material which the training required to be read made the using of many readers inevitable. In some instances the class charts give the names of the reading selections which were employed on the days in which the class averages in rate were made. This serves as a sort of check on the rate. It explains, in a number of cases, considerable variations which appear in the class average from day to day.

Changes in the degree of difficulty of different reading selections are somewhat of a disturbing factor in measuring the gradual growth in speed for a single class. They are much less of a disturbing factor, however, when the average represents not the mean of a single class but the central tendency of a fairly large number of classes. In other words, increases and decreases in degree of difficulty of selections tend, in a general way, to equalize each other when the average reflects the performance made on a large number of different selections. An illustration of this point may

be readily had by comparing the curve of progress, let us say, of a single fourth-grade class, with the curve of progress of all the fourth-grade classes, as shown in the composite Graph XII. The latter is seen to be much smoother and more regular in its progress.

Effect of the Training upon the Rate and Comprehension as Determined by the Courtis Tests

1. *Third-Grade Pupils*

Table VIII shows a rather remarkable gain in rate for the experimental pupils in two third-grade classes. From an average rate of 152.1 words per minute at the beginning of the experiment, the average rises to 239.5 words after one month of the experimental training. At the end of the two months of training the high average of 258.6 words per minute is reached. The average rate of the "control" pupils advances from 137 words per minute to 183.8 after a month of the conventional work in reading. In the course of the next month the rate has advanced but six words per minute, reaching a final average rate of 189.8 per minute. The average gain of the experimental pupils in rate is more than twice the average gain of the "control" group — 106.5 words per minute as contrasted with 52.7 words per minute.

What was the effect of this acceleration of the reading pace upon the comprehension? Beginning with an average index of comprehension of 76.4 per cent, the

TABLE VIII. COMPARISON OF THE RESULTS OF THE TRAINING IN RAPID SILENT READING WITH THE RESULTS OF THE CONVENTIONAL WORK IN READING

Total Number of Classes 2 — GRADE III — Total Number of Pupils 32

CITY	SCHOOL	NUMBER OF PUPILS	TEST I				TEST II				TEST III				TOTAL GAIN IN			
			A		B		A		B		A		B		A		B	
			Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.
Rushville	Webster	14	180.4	78.3	144.0	80.0	265.0	81.5	173.4	74.3	314.4	92.9	191.0	88.1	134.0	14.6	47.0	8.1
Streator	Grant	18	130.0	74.9	131.8	72.4	219.6	76.2	191.8	77.4	215.1	75.0	188.9	64.1	85.1	0.1	57.1	−8.3
Total		32	2433	1222	2194	1212	3832	1257	2940	1217	4137	1325	3037	1194	1704	103	843	−18
Average			152.1	76.4	137.1	75.7	239.5	78.6	183.8	76.1	258.6	82.8	189.8	74.6	106.5	6.4	52.7	−1.1
Total Superiority of A over B . .					239	10			892	40			1100	131			861	121
Average " " A " B . .					15	.6			55.7	2.5			68.8	8.2			53.8	7.5

To illustrate the reading of this table, the fourth line showing the averages is read thus: The rate of the experimental (A) pupils of the two schools in the first Courtis Test at the beginning of the training is 152.1 words per minute; their comprehension is 76.4%. The rate for the control (B) pupils is 137.1 words per minute, their comprehension is 75.7%. On the second Courtis Test given after one month of training, the rate for the experimental pupils is 239.5 words, their comprehension 78.6%; the rate for control pupils is 183.8, their comprehension 76.1% etc. Throughout this study, A is used to designate the experimental pupils; B, the control pupils.

score of the experimental pupils rises to 78.6 per cent after one month's training. At the end of the second month, it has mounted to 82.8 per cent — a gain of 6.4 per cent. The increase in rate has, therefore, been accompanied by an increase in comprehension. The "control" pupils began with an average index of 75.7 per cent and at the end of two months' conventional work in reading had dropped to 74.6 per cent — a decrease of 1.1 per cent. Consequently, the final average gain of the experimental pupils over the control group is 53.8 words per minute in rate and 7.5 per cent in comprehension.

A clearer understanding of the way in which records were assembled and compared perhaps requires that I should again refer to the system of pairing. It is to be understood that the 32 children constituting the two third-grade classes were arranged in sixteen pairs, each pair consisting of an "A" pupil and a "B" pupil. The sixteen "A" pupils taken together constituted the "A" group, and the sixteen "B" pupils taken together constituted the "B" group. The "A" group was taught by the experimental method, the "B" group by the usual method. The pupils were paired on a basis of their rate scores in the first Courtis Test. After the second and third Courtis Tests had been applied, all records of pupils were rejected if they were not present at all three of the tests, and no pupil's record was included unless the companion in the "pair" was also present at all the tests.

TABLE IX. COMPARISON OF THE NUMBER OF PUPILS IN THE EXPERIMENTAL (A) GROUP WHO SURPASSED THEIR CORRESPONDING PUPILS IN THE CONTROL (B) GROUP

GRADE III

	TEST I		TEST II		TEST III	
	Rate	Com.	Rate	Com.	Rate	Com.
Number of A equal to B .		2	1			
Number of B surpassing A .	7	8	3	7	4	9
Number of A surpassing B .	9	6	12	9	12	7
Group superiority A over B	2		9	2	8	
Group superiority B over A		2				2
Final superiority A over B in per cent					50	$-12\frac{1}{2}$

To illustrate the reading of Table IX, the fourth line showing the Group Superiority A over B is read thus: In the first Courtis Test, the group superiority of the experimental (A) pupils over the control (B) pupils in rate is 2 pupils; in comprehension, the "control" group excels the experimental by 2 pupils. In the second Courtis Test the experimental's superiority in rate is 9 pupils, in comprehension 2 pupils. At the end of the training, there are 12 experimental pupils surpassing their respective individual control pupils, while four members of the control group surpass their corresponding pupils in the experimental class. This leaves a final net group superiority of eight for the experimentals in rate, as against a final net group superiority of two for the control section in comprehension.

In Table IX the results of the method of individual control are shown. Here the averages are replaced by the number of pupils in one group who surpass their corresponding pupils in the other groups. The results of this method of control are largely corroborative of the results as shown by the average scores in Table VIII. When reduced to a percentage basis, Table IX shows a final net superiority of 50 per cent in rate for the experimental over the control group. The apparent

TABLE X. COMPARISON OF THE RESULTS OF THE TRAINING IN RAPID SILENT READING WITH THE RESULTS OF THE CONVENTIONAL WORK IN READING

Total Number of Classes 11 GRADE IV Total Number of Pupils 236

City	School	Number of Pupils	Test I				Test II				Test III				Total Gain			
			A		B		A		B		A		B		A		B	
			Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.
Argo	Argo	16	189.6	75.0	184.7	68.9	215.0	63.2	246.7	70.5	238.1	69.7	224.2	70.2	48.5	−5.2	39.5	1.4
Chicago	Hendricks	22	100.7	86.3	92.7	82.5	196.5	84.5	163.3	72.1	227.0	854.4	168.4	77.1	126.3	− .9	75.7	−5.5
La Salle	Jefferson	18	156.0	71.4	134.2	78.1	316.1	86.5	229.4	77.1	274.4	79.6	182.3	80.0	118.4	18.1	48.1	1.9
La Salle	Lincoln	20	130.3	80.3	150.7	86.2	175.4	91.8	161.4	86.3	201.2	96.2	176.4	87.8	70.9	15.9	25.7	1.6
Oregon	Oregon	24	207.3	77.6	209.3	74.3	275.1	81.6	233.9	84.5	298.9	85.2	251.7	84.3	91.6	7.7	42.6	9.9
Streator	Lincoln	18	164.3	74.3	171.9	78.5	204.3	74.9	169.5	71.1	188.2	82.0	169.0	82.1	23.9	7.7	−2.9	3.5
Streator	Grant	28	167.7	82.9	166.2	80.1	254.4	82.5	187.1	78.5	242.8	85.1	188.4	74.1	75.1	2.3	22.2	−6.0
Sycamore	Central	24	178.3	82.0	178.1	87.2	324.5	84.8	218.8	83.1	287.6	83.3	191.9	88.3	109.3	1.3	13.8	1.2
Taylorville	East	30	159.5	80.7	136.3	74.9	262.9	80.8	164.0	71.5	209.7	84.1	160.6	73.7	50.1	3.4	24.3	−1.2
"	Hewitt	18	143.2	68.9	157.9	86.1	150.0	75.5	129.4	85.0	149.5	71.1	119.8	79.1	6.3	2.2	38.1	−7.0
"	Oak St.	18	100.3	62.0	122.3	65.3					265.5	65.9	243.0	72.9	165.2	3.9	120.7	7.5
Total		236	18371	9128	18301	9277	26369	8851	20652	8501	27896	9623	22210	9328	9525	495	3909	51
Average			155.7	77.4	155.1	78.6	241.9	81.2	189.5	78.	236.4	81.6	188.2	79.1	80.7	4.2	33.1	.5
Total Superiority A over B					70	−149			5717	350			5686	295			5616	444
Average " A " B					.6	−1.2			52.4	3.2			48.2	2.5			47.6	3.7

NOTE. Table X is to be read in the same manner as Table VIII.

superiority of $12\frac{1}{2}$ per cent in comprehension for the control sections over the experimental pupils is discounted by the fact that they started with an initial group superiority of two pupils or $12\frac{1}{2}$ per cent.

The number of third-grade pupils who were matched into pairs, one being in the experimental class, the other in the control class, is too meager to justify any but the most tentative kind of conclusions. The pupils who survived the matching process were evidently the more capable ones, and consequently their performance can scarcely be said to be typical of third-grade pupils. The results do show, however, that third-grade experimental pupils profited noticeably by the training. The average rate of speed which they finally obtained is far in excess of the standard rate reported for that grade by any of the authors of the various standardized reading tests. Owing to the small number of third-grade pupils participating in the experiment, the writer will refrain from comparing these results with those obtained in the other grades with a much larger number of pupils.

2. *Fourth-Grade Pupils*

In Table X are shown the average scores of 11 fourth-grade classes. The total number of pupils is 236. The average rates of 155.7 words per minute for the experimental group, and of 155.1 for the control pupils, show that the two sections start the experiment with practically equal proficiency in rate. In comprehension, the two groups are also closely matched, the con-

trol pupils having an average index of 78.6 per cent as compared with 77.4 per cent for the experimentals.

TABLE XI. COMPARISON OF THE NUMBER OF PUPILS IN THE EXPERIMENTAL (A) GROUP WHO SURPASSED THEIR CORRESPONDING PUPILS IN THE CONTROL (B) GROUP

GRADE IV

	TEST I		TEST II		TEST III	
	Rate	Com.	Rate	Com.	Rate	Com.
Number of A equal to B	5	5	2	5	1	3
Number of B surpassing A	57	61	35	53	29	55
Number of A surpassing B	56	52	72	51	88	60
Group Superiority A over B . . .	—	—	37	—	59	5
Group Superiority B over A . . .	1	9	—	2	—	—
Final Superiority A over B in per cent					50	4

NOTE. Table XI is to be read in the same manner as Table IX.

After one month of training in rapid reading, the experimentals have reached an average rate of 241.9 as compared with 189.5 for the controls. In comprehension they have more than held their own, mounting to an average index of 81.2 as compared with 78.0 for the controls. At the end of the second month of training, the average rate for the experimentals is 236.4 words per minute as contrasted with 188.2 for the controls. The average gain in rate for the two months is 80.7 words per minute for the experimentals as against 33.1 for the controls — an average superiority in gain of 47.6 for the experimental pupils.

The story told in Table X is very largely reflected by Table XI. At the beginning of the experiment, the two groups displayed practically equal ability in read-

TABLE XII. COMPARISON OF THE RESULTS OF THE TRAINING IN RAPID SILENT READING WITH THE RESULTS OF THE CONVENTIONAL WORK IN READING

Total Number of Classes 7 — GRADE V — Total Number of Pupils 154

City	School	Number of Pupils	Test I				Test II				Test III				Total Gain			
			A		B		A		B		A		B		A		B	
			Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.
Argo	Argo	26	299.2	85.0	287.8	90.5	265.9	87.5	258.0	90.1	300.0	82.8	261.6	89.0	0.8	−2.2	−26.1	−1.5
Bloomington	St. Mary's	22	192.1	78.0	213.5	87.3	215.8	90.6	223.8	93.2								
Chicago	Hendricks	22	118.8	78.5	121.0	88.0	222.5	79.4	178.7	92.2	227.0	87.5	203.7	92.8	108.2	8.9	82.7	4.8
"	"	24	108.7	83.0	105.4	80.1	199.1	88.7	183.1	84.8	189.9	85.2	157.4	85.3	81.2	2.2	52.0	5.2
"	Manierre	14	138.8	72.7	152.6	74.3					269.4	78.4	195.3	77.8	130.6	5.7	42.7	3.6
Streator	Garfield	22	218.9	93.6	213.5	93.3	364.1	95.5	277.3	92.9	384.3	93.4	276.4	92.4	165.3	−0.2	62.8	−0.8
"	Plumb	24	224.2		223.2		325.5	80.8	230.0	87.4	295.9	84.4	227.0	90.3	71.7	3.7	3.9	2.9
Total		154	14683	5362	14781	5613	18578	6092	15790	6299	18339	5651	14663	5847	5769	177	2230	145
Average			190.7	82.5	191.9	86.3	265.4	87.0	225.6	89.9	277.8	85.6	222.1	88.6	87.1	2.9	30.2	2.3
Total Superiority A over B					−98	−251			2788	−207			3676	−196			3539	32
Average " A " B					−1.2	−3.8			39.8	−2.9			55.7	−3.0			56.9	0.6

NOTE. Table XII is to be read in the same manner as Table VIII.

ing. This is noticeably so in regard to rate. Among 118 pairs of pupils, there are 5 pairs in which the scores of the two pupils are exactly the same, 57 pairs in which the experimental pupil is a trifle faster than his checkmate, and 56 pairs in which the reverse is true.

TABLE XIII. COMPARISON OF THE NUMBER OF PUPILS IN THE EXPERIMENTAL (A) GROUP WHO SURPASSED THEIR CORRESPONDING PUPILS IN THE CONTROL (B) GROUP

GRADE V

	TEST I		TEST II		TEST III	
	Rate	Com.	Rate	Com.	Rate	Com.
Number of A equal to B	4	5	3	5	—	4
Number of B surpassing A	25	34	19	35	12	34
Number of A surpassing B	48	26	48	30	54	28
Group Superiority A over B	23	—	29	—	42	—
Group Superiority B over A	—	8	—	5	—	6
Final Superiority A over B in per cent					$63\frac{1}{2}$	$-9\frac{1}{2}$

NOTE. Table XIII is to be read in the same manner as Table IX.

At the end of the experiment, the experimental group shows a superiority of 50 per cent in rate, and 4 per cent in comprehension. These percentages of superiority of the experimental group over the control group almost coincide with the superiority indicated by Table X. The two methods of control thus serve to corroborate the same general conclusions and mutually to reënforce each other.

3. *Fifth-Grade Pupils*

The effect of the experimental training upon the pupils in the fifth grade is shown in Table

XII.[1] It includes seven classes comprising a total of 154 pupils. Here again it will be noted that both the A and B groups commenced the experiment with equal initial proficiency in rate, 190.7 for the experimental as compared with an average of 191.9 words per minute for the controls. The latter have somewhat of an advantage in comprehension — 86.3 as against 82.5 for the experimentals.

At the end of the first month the average of the A group had mounted to 265.4 as compared with 225.6 for the B group. After another month of training, the experimentals had increased their lead over their checkmates by reaching an average of 277.8 as against 222.1 for the controls. The final averages for comprehension are 85.6 for the A group and 88.6 for the B group. This reflects an average gain of 2.9 as compared with 2.3 for the controls — an average superiority in gain for the experimentals of 0.6. More conspicuous is the average superiority of gain in rate of the experimentals over the controls, 87.1 as against 30.2 — an average superiority of 56.9.

A comparison of Table XII with Table X shows that the amount of gain in rate made by both the experimental and control sections in grade 4 is very similar to the gains made by the experimental and control groups respectively in grade 5. The average gain in

[1] Owing to the failure to test the comprehension of the pupils in the fifth grade in the Plumb School, the number of pairs whose scores in comprehension were recorded is not quite the same as the number of pairs whose rates of speed are compared.

rate for the A group in grade 5 is 87.1 words per minute as compared with 80.7 for the corresponding group in grade 4 — an average superiority in gain of 6.4 words per minute for the fifth grade. The controls in grade 5 scored a gain of 30.8 as against an average gain of 33.1 words per minute for the controls in grade 4 — a difference of 2.3 in favor of grade 4. On the whole, the average gain in rate of the fifth grade is superior to that of the fourth grade; so also is the final average rate to which the fifth grade attains — 277.8 words per minute as against 236.4 for the experimentals in the fourth grade.

The final net superiority in rate of the experimentals in grade 5 over their checkmates as determined by the method of individual control, as shown in Table XIII, is 42 pupils. This means that out of 66 pairs of pupils who were closely matched at the beginning of the experiment, 54 experimental pupils surpassed their checkmates in rate of reading at the end of the training, as against 12 control pupils who surpassed their corresponding experimental pupils in rate. This leaves a final superiority of 42 pupils in favor of the A group, or a superiority of $63\frac{1}{2}$ per cent. In comprehension, Table XIII shows a superiority of 6 pupils or $9\frac{1}{2}$ per cent in favor of the B group. This latter is discounted, however, by the fact that the B section started with an initial superiority of 8 over the A group. The training received by the experimentals reduced this lead to 6.

TABLE XIV. COMPARISON OF THE RESULTS OF THE TRAINING IN RAPID SILENT READING WITH THE RESULTS OF THE CONVENTIONAL WORK IN READING

Total Number of Classes 5 — GRADE VI — Total Number of Pupils 128

City	School	Number of Pupils	Test I				Test II				Test III				Total Gain			
			A		B		A		B		A		B		A		B	
			Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.
Blooming-ton	St.Mary's	24	209.5	96.9	189.3	95.4	279.7	99.0	218.2	36.4								
Rushville	Webster	22	174.8	84.9	176.8	89.0	229.5	86.2	217.1	92.4	235.9	90.5	204.2	91.6	61.1	5.6	27.4	2.6
Streator	Grant	32	209.9	92.0	219.3	94.4	309.3	86.6	249.2	86.7	303.4	85.9	241.8	85.7	93.5	−6.1	22.6	−8.6
"	Greeley	22	203.3	92.4	223.4	95.1	379.4	90.3	277.9	88.4	412.0	87.7	298.7	90.3	208.7	−4.7	75.3	−4.8
"	Sherman	28	187.7	88.4	207.1	88.8	229.8	92.5	215.4	89.6	231.1	89.2	201.4	87.7	43.3	0.8	−5.6	−1.1
Total		128	12601	5824	13081	5924	18221	5809	15067	5789	15217	4585	12221	4601	5071	−76	1412	−178
Average			197.8	91.0	204.4	92.6	284.7	90.8	235.4	90.4	292.6	88.2	235.0	88.5	94.8	−2.8	30.6	−4.1
Total Superiority A over B					−480.0	−100.0			3154.0	20.0			2996.0	−16.0			3659.0	102.0
Average " A " B					−6.6	−1.6			49.3	0.4			57.6	−0.3			64.2	1.3

NOTE. Table XIV is to be read in the same manner as Table VIII.

4. *Sixth-Grade Pupils*

The results of the training upon five sixth-grade classes having a total of 128 pupils are shown in Table XIV. The average rate of 197.8 words per minute for the experimentals mounted to 284.7 after a month's training; by the end of the training period they had attained an average of 292.6 words per minute. The control sections started with an average rate of 204.7 — an average initial superiority of 6.6 words per minute over the experimental pupils. After a month of the conventional reading work, the controls averaged 235.4; during the second month their rate remained practically stationary as shown by their average of 235.0 at the end of the experiment. The final average gain in rate for the A group is 94.8 words per minute as compared with 30.6 for the B group, a superiority in gain of 64.2 for the experimental pupils.

TABLE XV. COMPARISON OF THE NUMBER OF PUPILS IN THE EXPERIMENTAL (A) GROUP WHO SURPASSED THEIR CORRESPONDING PUPILS IN THE CONTROL (B) GROUP

GRADE IV

	TEST I		TEST II		TEST III	
	Rate	Com.	Rate	Com.	Rate	Com.
Number of A equal to B	3	10	1	8	—	2
Number of B surpassing A	38	28	23	33	8	24
Number of A surpassing B	23	26	40	23	44	26
Group Superiority A over B . . .	—	—	17	—	36	2
Group Superiority B over A . . .	15	2	—	10	—	—
Final Superiority A over B in per cent					69	4½

NOTE. Table XV is to be read in the same manner as Table IX.

TABLE XVI. COMPARISON OF THE RESULTS OF THE TRAINING IN RAPID SILENT READING WITH THE RESULTS OF THE CONVENTIONAL WORK IN READING

Total Number of Classes 10 GRADE VII Total Number of Pupils 206

City	School	Number of Pupils	Test I				Test II				Test III				Total Gain			
			A		B		A		B		A		B		A		B	
			Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.
Chicago	Hendricks	26	175.1	94.5	171.0	90.2	266.1	95.0	217.0	92.0	278.8	92.2	211.2	90.3	103.7	−2.2	40.2	0.1
La Salle	Grant	10	181.8	94.0	184.8	93.8	265.8	98.2	216.4	96.4	294.0	91.4	239.6	95.8	112.2	−2.6	54.8	2.0
" "	Jefferson	20	175.0	94.0	183.0	91.2	335.0	95.8	232.6	95.5	345.3	95.1	286.0	89.5	170.3	1.1	103.0	−1.7
Oregon	Oregon	28	258.8	90.6	262.3	92.1	361.2	91.6	268.4	93.5	355.4	94.1	270.7	93.6	96.6	3.6	8.3	1.6
Streator	Greeley	24	227.5	92.6	210.9	96.5	322.6	97.3	239.3	97.4	413.3	92.9	220.8	93.4	185.8	0.3	9.8	−3.1
Sycamore	Central	24	189.6	94.6	181.0	92.2	260.2	92.6	202.5	96.0	275.9	92.5	250.3	92.7	86.3	−2.1	69.3	0.4
Taylorville	East	18	198.1	97.2	183.4	94.4	313.7	95.0	240.8	88.3	320.4	95.8	232.9	92.0	122.3	−1.4	50.4	−1.3
"	Hewitt	16	215.1	77.0	216.4	83.0	268.5	91.1	246.9	88.1	268.4	89.6	257.6	86.9	53.2	12.6	41.3	3.9
"	Oak	18	227.0	90.8	191.8	90.3	349.3	94.0	262.0	90.2	344.2	92.2	309.1	92.0	117.2	1.4	117.3	1.7
"	West	22	188.2	84.7	218.9	87.8	222.3	92.0	237.3	96.4	290.8	86.0	230.4	87.7	102.6	1.3	11.5	−0.9
Total		206	21180	9392	20860	9401	30748	9688	24434	9635	33121	9505	25720	9418	11941	113	4860	17
Average			205.6	91.2	202.5	91.3	298.5	94.1	237.2	93.5	321.6	92.3	249.7	91.4	116.0	1.1	47.2	.1
Total Superiority A over B					320	−9			6314	53			7401	87			7081	96
Average " A " B					3.1	−.1			61.3	.6			71.9	.9			68.8	1.0

NOTE. Table XVI is to be read in the same manner as Table VIII.

In point of comprehension Table XIV shows a slight decrease for both the A and the B groups. The average index of comprehension of the A group at the beginning of the training is 91.0 as against 88.2 at the end. The average for the control pupils drops from 92.6 to 88.5 — a decrease of 4.1 as against 2.8 for the experimentals. This would seem to indicate that the decrease, slight as it is, cannot be attributed to their acceleration in reading rate. For the control pupils, whose gain in rate is less than one-third the gain of the experimental pupils, decreased about one and a half times as much in comprehension as the experimentals. The decrease in the case of the experimentals is so slight as to be of no special significance.

TABLE XVII. COMPARISON OF THE NUMBER OF PUPILS IN THE EXPERIMENTAL (A) GROUP WHO SURPASSED THEIR CORRESPONDING PUPILS IN THE CONTROL (B) GROUP

GRADE VII

	TEST I		TEST II		TEST III	
	Rate	Com.	Rate	Com.	Rate	Com.
Number of A equal to B	5	12	1	18	—	7
Number of B surpassing A	39	41	25	39	20	42
Number of A surpassing B	59	50	77	46	83	54
Group Superiority A over B . . .	20	9	52	7	63	12
Group Superiority B over A . . .	—	—	—	—	—	—
Final Superiority A over B in per cent					61	11½

NOTE. Table XVII is to be read in the same manner as Table IX.

Table XV tells very much the same story as Table XIV. The conclusions issuing from the two methods of control — group and individual — serve to reënforce

each other. The outstanding facts shown by Table XV are these: From a total of 64 pairs of pupils, 38 controls surpassed their corresponding experimentals, as against 23 experimentals who surpassed their checkmates. At the end of the experiment, from a total of 52 pairs, 44 experimentals excelled their checkmates, as contrasted with the eight controls who surpassed their experimentals. Reduced to a percentage basis, the A group surpassed the B group by 69 per cent in rate and $4\frac{1}{2}$ per cent in comprehension.

5. *Seventh-Grade Pupils*

The records of the seventh-grade classes totaling 206 pupils are presented in Table XVI. Both groups commence with approximately equal averages in rate and comprehension. In the latter respect, the two averages differ by but 0.1. A month's training in rapid reading brings the average of the experimentals from 205.6 per minute to 298.5, whence it rises to 321.6 by the end of the second month. The experimentals far outstrip their checkmates whose rate during the same two months of conventional work in reading reaches only 249.7 words per minute. The average gain of the A group is 116.0 as compared with 47.2 for the B group — an average superiority in gain of 68.8. In comprehension the experimentals likewise surpass their checkmates. Their average rises from 91.2 to 92.3 as compared with the slight increase from 91.3 to 91.4 by the control pupils. The superiority of gain

TABLE XVIII. COMPARISON OF THE RESULTS OF THE TRAINING IN RAPID SILENT READING WITH THE RESULTS OF THE CONVENTIONAL WORK IN READING

Total Number of Classes 3 GRADE VIII Total Number of Pupils 92

City	School	Number of Pupils	Test I				Test II				Test III				Total Gain			
			A		B		A		B		A		B		A		B	
			Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.	Rate	Com.
Chicago	Hendricks	32	150.3	93.9	135.8	98.4	351.9	90.9	248.2	95.6	363.2	93.4	254.3	98.8	212.9	−0.5	118.4	−3.6
Streator	Garfield	34	251.8	96.2	254.1	94.8	370.2	95.8	317.3	96.3	378.7	94.9	341.8	93.3	126.9	−1.2	60.6	−1.5
"	Greeley	26	267.0	97.6	249.6	96.5	361.0	96.6	307.5	96.9	448.3	96.5	343.3	94.5	181.3	−1.1	93.7	−2.1
Total		92	10156	4406	9738	4441	16617	4339	13364	4428	18077	4363	13882	4330	7921	−43	4144	−111
Average			220.8	95.8	211.7	96.5	361.2	94.3	290.5	96.3	393.0	94.8	301.8	94.1	172.2	−1.0	90.1	−2.4
Total Superiority A over B					418	−35			3253	−89			4195	33			3777	68
Average " A " B					9.1	−.7			70.7	−2			91.2	.7			82.1	1.4

NOTE. Table XVIII is to be read in the same manner as Table VIII.

in comprehension by the A group is not, however, very appreciable, being but 1.0.

On the basis of the method of individual control, Table XVII shows a superiority of 61 per cent in rate and 11 per cent in comprehension in favor of the experimental group over the control pupils.

6. *Eighth-Grade Pupils*

From the fourth grade on, the tables have shown an increase in the amount of gain by the experimentals as the grade advanced. This is especially true of the eighth grade, where the amount of gain is greater than that of any of the lower grades. From an average rate of 220.8, the A group rises to 361.2 after one month's training, and to 393.0 at the end of the second month. This is the highest average rate of speed which any of the experimental groups attained on the

TABLE XIX. COMPARISON OF THE NUMBER OF PUPILS IN THE EXPERIMENTAL (A) GROUP WHO SURPASSED THEIR CORRESPONDING PUPILS IN THE CONTROL (B) GROUP

GRADE VIII

	TEST I		TEST II		TEST III	
	Rate	Com.	Rate	Com.	Rate	Com.
Number of A equal to B	6	10	1	6	—	4
Number of B surpassing A	9	16	11	25	13	16
Number of A surpassing B	31	20	34	15	33	26
Group superority A over B	22	4	23	—	20	10
Group superiority B over A	—	—	—	10	—	—
Final superiority A over B in per cent					43½	22

NOTE. Table XIX is to be read in the same manner as Table IX.

TABLE XX. TABLE SHOWING AVERAGE RATE OF READING FOR EXPERIMENTAL (A) AND "CONTROL" (B) PUPILS AT BEGINNING AND END OF TRAINING PERIOD AS DETERMINED BY COURTIS SILENT READING TEST FOR GRADES IV–VIII

Grade	Number of Pupils	Test I		Test II		Test III		Gain		A's Superiority in Gain	
		A	B	A	B	A	B	A	B		
IV .	236	155.7	155.1	241.9	189.5	236.4	188.2	80.7	33.1	47.6	31%
V . .	154	190.7	191.9	265.4	225.6	277.8	222.1	87.1	30.2	56.9	30%
VI .	128	197.8	204.4	284.7	235.4	292.6	235.	94.8	30.6	64.2	33%
VII .	206	205.6	202.5	298.5	237.2	321.6	249.7	116.0	47.2	68.8	33%
VIII .	92	220.8	211.7	361.2	290.5	393.0	301.8	172.2	90.1	82.1	35%

Average gain of A for all grades = 56%; of B = 25%; A's superiority over B = 31%.

TABLE XXI. TABLE SHOWING AVERAGE COMPREHENSION IN READING FOR EXPERIMENTAL (A) AND "CONTROL" (B) PUPILS AT BEGINNING, MIDDLE, AND END OF TRAINING PERIOD AS DETERMINED BY COURTIS SILENT READING TEST

Grade	Number of Pupils	Test I		Test II		Test III		Gain		A's Superiority in Gain
		A	B	A	B	A	B	A	B	
IV . .	236	77.4	78.6	81.2	78.0	81.6	79.1	4.2	.5	3.7
V . .	154	82.5	86.3	87.0	89.9	85.6	88.6	2.9	2.3	0.6
VI . .	128	91.0	92.6	90.8	90.4	88.2	88.5	−2.8	−4.1	1.3
VII .	206	91.2	91.3	94.1	93.5	92.3	91.4	1.1	0.1	1.0
VIII .	92	95.8	96.5	94.3	96.3	94.8	94.1	−1.0	−2.4	1.4

Average gain of A for all grades = .09%; of B = −0.7%; A's superiority over B = 1.6%.

Courtis Test. The controls likewise achieved the considerable gain of 90.1 words — mounting from 211.7 to 301.8. It is, however, just about half the gain made by the experimentals — 90.1 as against 172.2 for the experimental group. The averages for comprehension

have varied but little in the case of both groups — a decrease of 2.4 for the controls as against a decrease of 1.0 for the experimentals.

Summary of Effects of the Training upon All Grades

The results of the preceding tables in regard to the average rates of the different grades are summed up in Table XX. The advancement in rate of reading as shown in the three tests is fairly uniform as the grade increases. From an average in the first Courtis Test of 155.7 words per minute for the experimentals in the fourth grade, the average continues to advance until in the eighth grade it reaches 220.8. At the end of the training, the average for the A groups rises from 236.4 words per minute in the fourth grade until it reaches 393.0 in the eighth grade. Reducing the average gains in number of words read per minute to a percentage basis, it becomes possible to express the amount of improvement for the experimental pupils in all the grades in a single term — 56 per cent. The average gain for the control pupils in all the grades is 25 per cent. This shows a final average superiority in gain for the experimental pupils over their checkmates of 31 per cent. In terms of the number of words read per minute the average gain of the A group is 110.2 as against 46.2 for the B group — an average superiority in gain of 64 words per minute in favor of the experimental or A group.

A summary of the scores of the different grades in comprehension is presented in Table XXI. The gains or losses for neither group are especially significant. The only gains which appear at all appreciable occur in the experimental sections in the fourth and fifth grades — gains of 4.2 and 2.9 respectively. The final average gain of the experimental groups in all the grades is 0.9 per cent as against an average loss of 0.7 per cent for the control pupils. This gives the experimental groups an average superiority in gain in comprehension of 1.6 per cent over the control groups. The measure of comprehension here used is the index computed according to the directions of Courtis. The results of the application of a somewhat different measure of the efficiency of comprehension, namely, the number of questions correctly answered in five minutes, will be presented later.

A summary of the results of the experimental training upon the rate and comprehension in all the grades as shown by the method of individual control is presented in Tables XXII and XXIII. Table XXII shows that at the beginning of the experiment there were 401 pairs of pupils, one of each pair being in the experimental and the other in the control group. The pupils constituting each pair were approximately evenly matched, though at times the variation between the pupils in a pair was not inappreciable. The amount of variation to be found in the rates of any class of pupils is such as to render very small the number of

pupils who score exactly the same rate. Of the 401 pairs in the present investigation there were 23 experimentals whose scores were identical with those of their checkmates; while 165 controls were superior to their corresponding experimentals as against 213 experimentals who were above their controls. In both the latter cases the differences as a rule were slight, as was evidenced by the close similarities of their averages.

At the end of the training the results were: one pair identically equal; 86 controls superior to their correspondents in the experimental group as contrasted with 314 experimentals who were superior to their controls — a final net superiority of 228 pairs for the experimentals. Subtracting from this total the amount of A's initial superiority of 48, the results show a final superiority in gain of the A group over the B group of 180 pupils, or 45 per cent.

Table XXIII shows that the B group starts the experiment with somewhat of a superiority over the A group in comprehension. Of a total of 389 [1] pairs, 41 pairs have the same scores for each of the members of the pair, while 180 controls surpassed their experimentals as against 168 experimentals who surpassed their checkmates, — an initial superiority of 12 in favor of the B group. At the end of the training there were 20 pairs whose members have equal scores, while 180 controls surpassed their experimentals as against

[1] Reduced from 401 pairs because, as indicated, 12 pairs in the fifth grade were not rated in comprehension.

TABLE XXII. COMPARATIVE EFFECTIVENESS OF THE EXPERIMENTAL AND CONVENTIONAL TYPE OF READING WORK UPON THE RATE OF GRADES III TO VIII, AS SHOWN BY THE METHOD OF INDIVIDUAL CONTROL

Grade	Test I							Test II							Test III						
	III	IV	V	VI	VII	VIII	Total	III	IV	V	VI	VII	VIII	Total	III	IV	V	VI	VII	VIII	Total
Number of A equal to B	—	5	4	3	5	6	23	1	2	2	1	1	1	8	—	1	—	—	—	—	1
Number of B surpassing A	7	57	21	32	39	9	165	3	35	14	13	25	11	101	4	29	12	8	20	13	86
Number of A surpassing B	9	56	41	17	59	31	213	12	72	43	38	77	34	276	12	88	54	44	83	33	314
Group Superiority A over B	2	—	20	—	20	22	64	9	37	29	25	52	23	175	8	59	42	36	63	20	228
Group Superiority B over A	—	1	—	15	—	—	16	—	—	—	—	—	—	—	—	—	—	—	—	—	—

TABLE XXIII. COMPARATIVE EFFECTIVENESS OF THE EXPERIMENTAL AND CONVENTIONAL TYPE OF READING WORK UPON THE COMPREHENSION OF GRADES III TO VIII, AS SHOWN BY THE METHOD OF INDIVIDUAL CONTROL

Grade	Test I							Test II							Test III						
	III	IV	V	VI	VII	VIII	Total	III	IV	V	VI	VII	VIII	Total	III	IV	V	VI	VII	VIII	Total
Number of A equal to B	2	5	5	7	12	10	41	—	5	3	3	18	6	35	—	3	4	2	7	4	20
Number of B surpassing A	8	61	28	26	41	16	180	7	53	30	31	39	25	185	9	55	34	24	42	16	180
Number of A surpassing B	6	52	21	19	50	20	168	9	51	26	18	46	15	165	7	60	28	26	54	26	201
Group Superiority A over B	—	—	—	—	9	4	13	2	—	—	—	7	—	9	—	5	—	2	12	10	29
Group Superiority B over A	2	9	7	7	—	—	25	—	2	4	13	—	10	29	2	—	6	—	—	—	8

201 experimentals who were superior to their controls — a superiority of 21 in favor of the experimentals. This number is to be augmented by 12, the handicap under which the A group started, giving a final superiority in gain in comprehension of 32 pairs or 8 per cent for the experimental pupils over their control pupils.

The results of the method of individual control serve as a powerful reënforcement of a refined type of the conclusions issuing from a comparison of the average scores of the two groups. This method of control shows furthermore that the superiority of the experimental group over the control group is not due merely to a very marked superiority of a rather small number of pupils, but that the superiority is spread very largely throughout the whole group.

CHAPTER IX

INTERPRETATION OF RESULTS

The Effect of the Training upon Reading Rate

Graph I illustrates the data contained in Table XX. It presents very clearly the differences in amount of improvement in reading rate achieved by the experimental pupils and the controls. While in every grade the two groups start at practically the same level of reading rate, yet in every grade the experimental pupils far outstrip the controls. The bulk of improvement, it will be noticed, is effected in the first month of the training. With the exception, however, of the fourth grade, in which there occurs a very slight decrease, improvement of a lesser character continues during the second month.

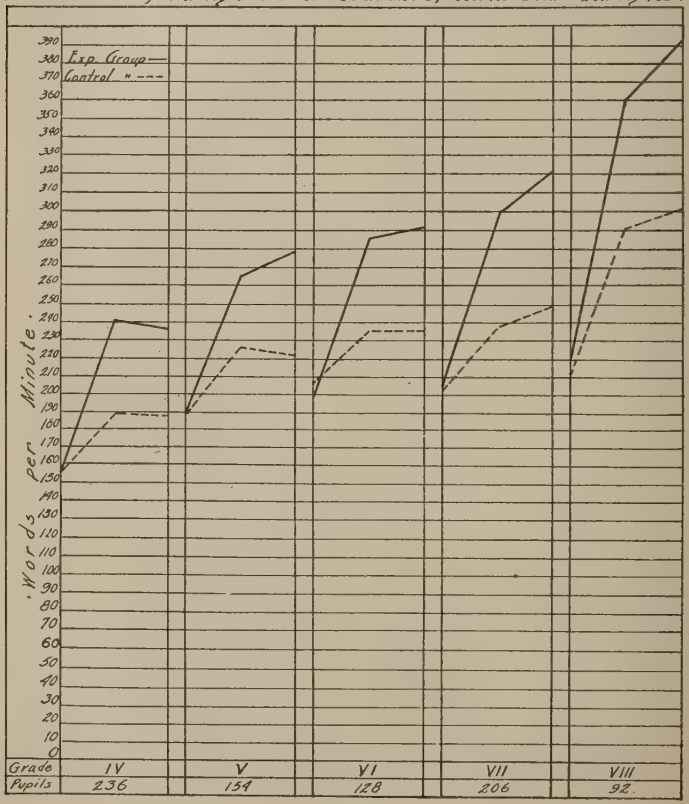
The decided improvement made by the pupils as a result of the first month of the training would seem to indicate that the customary reading rate of pupils was far below the rate at which they could read intelligently and efficiently. In other words, they were not working on the maximum plane of efficiency. Thus the pupils in the seventh grade are able to increase their rate 116 words per minute, while the eighth-grade pupils succeed

in almost doubling their rate — without in either case experiencing any appreciable decrease in comprehension. In fact, in one case, a slight improvement is

No. I

Graph Showing

Average Rate of Reading for Experimental (A) and Control (B) Pupils at Beginning Middle and End of Training Period as Determined by Courtis Silent Reading Test.



effected. This result gives some point to the query: Is not the reading of most individuals done at slow, plodding rates which are far below the levels attainable by a little training? The results portrayed in Graph I point strongly in that direction.

The Effect upon Comprehension

That the comprehension has not been greatly affected either favorably or adversely is shown by Graph II. The comprehension remained constant to a large extent in both the experimental and control groups. The slight superiority in gain that does exist, however, is in each grade in favor of the experimental pupils. The conclusions that would seem to follow from the performances of the pupils in comprehension in this study are:

1. Marked increases in speed of reading may be effected without any impairment of the comprehension.

2. The setting up of habits of rapid reading does not *per se* increase the accuracy of the comprehension.

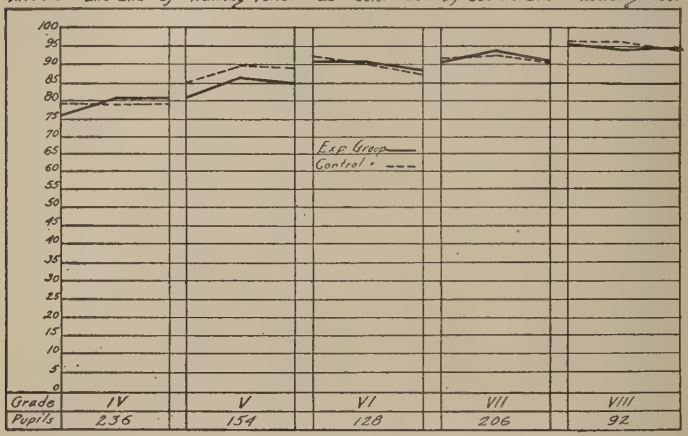
3. To secure marked improvement in accuracy of comprehension special stress must be placed upon training designed specifically to increase the accuracy of the comprehension.

While the experimental training outlined in this study succeeded in safeguarding and even slightly improving the accuracy of the comprehension, yet its predominant

effect was the marked acceleration of the reading rate. To produce such an effect upon the rate was precisely the end for which the training was devised.

No II

Graph showing Average Comprehension in Reading for Experimental (A) and Control (B) Pupils at Beginning, Middle and End of Training Period as determined by Courtis Silent Reading Test.



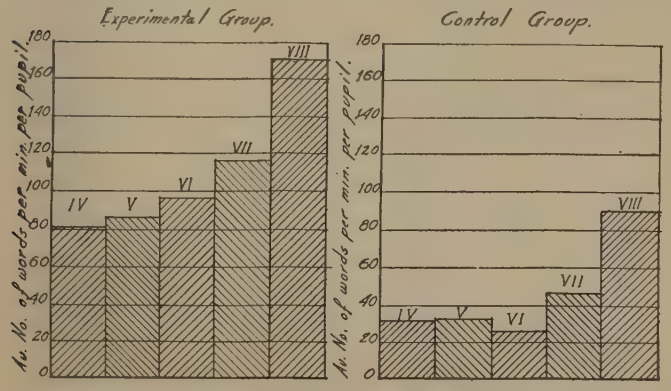
The Relative Amount of Gain Made by Different Grades

A comparison of the amount of gain in rate made by the experimental and control pupils in each of the grades is given in Graph III. The graph brings out clearly the fact that *the amount of gain increases as the grade advances.* In every case in the experimental groups the gain made by the higher grade is superior to that made by the lower. With the single exception of the sixth grade, this is true likewise of the control groups.

This superiority in gain in rate by the upper grades over the lower is quite the opposite of what has usually been reported concerning the relative gains made by the different grades. The third and fourth grades have been of late generally regarded as the crucial school periods during which the appreciable increases in rate of reading are to be effected. The results re-

No III

Graph Showing Average Gain in Rate of Reading for Grades IV to VIII as determined by Courtis Silent Reading Test



ported by W. S. Gray, Judd, Courtis, and Waldo have shown that *de facto* the important gains are made in the lower grades, especially in the third and fourth. What is the explanation of the difference of the relative amount of gain made by the different grades as reported by other investigators and those reported in the present study? In the writer's judgment the explanation is not far to seek.

The gains reported by other investigators were the results of the conventional type of training in reading with almost the entire emphasis upon the oral phase. The matter of rapidity in silent reading has not as yet become a problem in the minds of the majority of upper grade teachers, much less in the minds of their pupils. During the third and fourth grades, great stress is placed by the teachers upon the mastery of the mechanics of reading. Generous portions of time are devoted to this task. After this has been accomplished, the pupils are allowed to slumber along at the slow, dead-level plodding rates which became fixed for them in the days of sempiternal drill in oral reading. Reading from the fourth grade on continues largely as an exhibition of word pronouncing, articulation, etc. As Judd aptly phrases it, "The conscientious teacher supplied with a reading book and a period in the program carries on the well-known reading farce in the vain hope that the effects of unsuccessful teaching will be overcome by a liberal application of the same methods that produced the difficulties."

The value of an acceleration of the rate in silent reading never seems to dawn upon them. It is no wonder that the rate does not notably rise as the grade advances. The wonder, rather, is that the rate does not decrease as a result of the grotesquely misplaced emphasis on oral reading and the school's utter neglect of reading in the true sense of the term — the silent interpretation of the printed symbols.

The increases in reading rate in the different grades as reported by K. D. Waldo are shown in Table XXIV. The increases effected in the upper grades as a result of almost a year's teaching of reading are so meager as to be scarcely perceptible — 2.1 and 11.7 words in the sixth and eighth grades respectively. The rate is practically at a standstill from the fourth grade on. A condition such as this is, in the writer's judgment, nothing less than pathological. It is a serious indictment of the present school régime in the teaching of reading.

In the present investigation rapidity in silent reading was made a problem. It was recognized as a value to be striven for and to be achieved through training. Graph III shows the results of the pupils' effort. They secured that for which they strove.

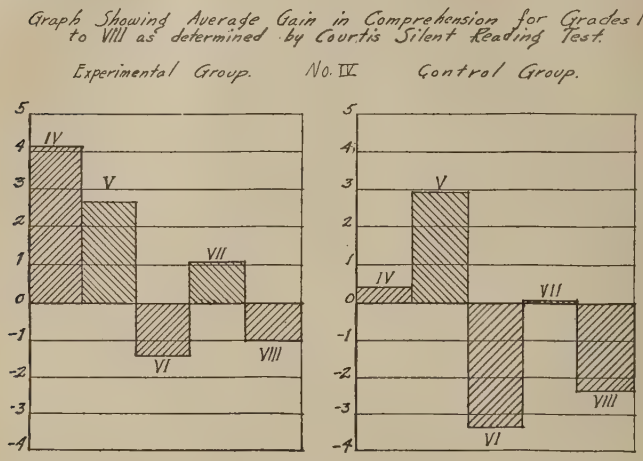
From these results three conclusions would seem to follow:

1. Marked increases in rate can be effected in the upper grades when speed in reading is made a problem in the minds of the pupils.

2. When training in rapid silent reading is given to pupils not previously trained therein, the acceleration in rate tends in a general way to advance *pari passu* with the advance in the grade — the higher the grade, the greater being the increase in rate.

3. The present average rates in the upper grades are unnecessarily slow, due to the absence on the part of the school of any organized effort to accelerate them.

The data concerning the gains in comprehension contained in Table XXI are shown in Graph IV. It is



to be noted that no grade in either the experimental or the control group varies more than about four points from its initial average.

TABLE XXIV. THE INCREASE IN READING RATE IN THE DIFFERENT GRADES AS REPORTED BY K. D. WALDO

GRADE	FALL RATE	SPRING RATE	INCREASE IN	
			NUMBER OF WORDS	PER CENT
3	76.4	149.1	72.7	95.2
4	92.7	163.3	70.6	76.1
5	113.0	129.2	16.2	14.3
6	128.0	130.1	2.1	1.2
7	122.7	142.8	20.1	16.4
8	147.2	158.9	11.7	8.0

TABLE XXV. COMPARISON OF AVERAGES IN RATE ATTAINED BY PUPILS AFTER TRAINING — WITH PRESENT NORMS

GRADE	IV	V	VI	VII	VIII
O'Brien	236	278	293	322	393
Oberholtzer	156	186	234	282	288
Courtis	160	180	220	250	280
Gary	140	166	185	198	204
Starch	144	168	192	216	240
Brown	213	269	272	279	290
Gray	180	204	216	228	234

TABLE XXVI. TENTATIVE NORMS FOR PUPILS TRAINED IN RAPID SILENT READING

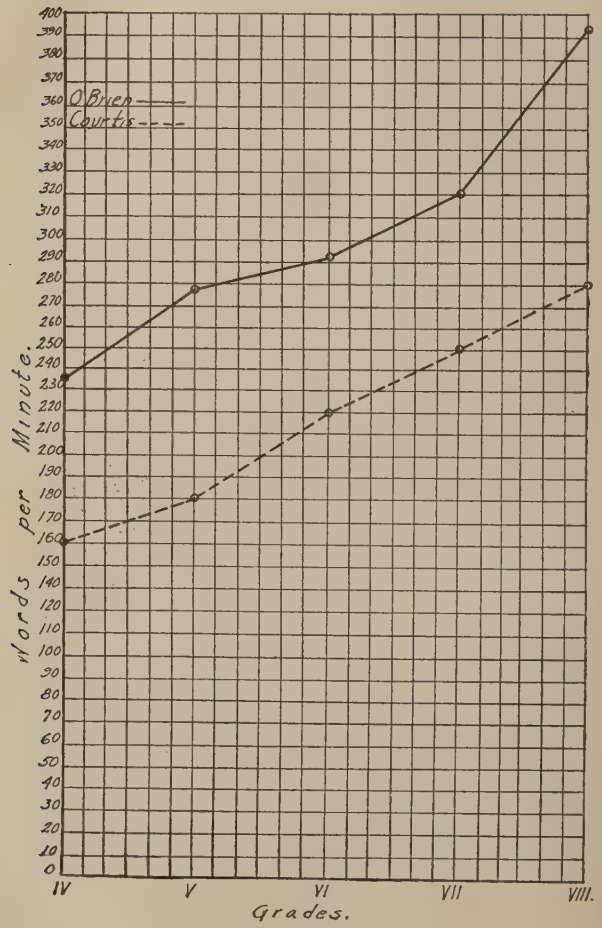
GRADE	ACTUAL AVERAGE	P. E.	SUGGESTED NORMS
IV	236.4	12.13	236
V	277.8	8.37	266
VI	292.6	8.71	296
VII	321.6	7.01	326
VIII	393.0	12.77	356

Average Rates Attained by Pupils After Training Compared with Present Norms

A comparison of the averages of the experimental pupils in grades 4 to 8 with the norms reported by Courtis, Brown, Gray, Starch, and Oberholtzer is presented in Table XXV. There is a common basis of comparison between the averages of the experimental pupils and the norms reported by Courtis. Both were achieved on the Courtis Test and the directions to the pupils

No. V

Graph showing Average Rate for Pupils after Training in Rapid Reading as compared with Norms reported by Courtis for Ordinary Readers.



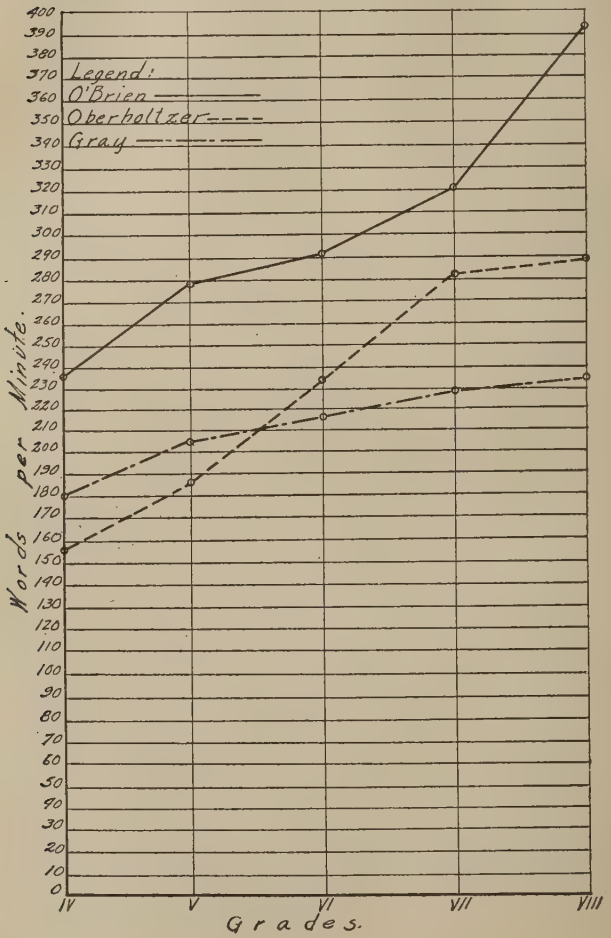
in both cases were identical. The norms reported by Courtis represent the smoothed averages, the figures presented by the writer are the actual averages. A comparison of these two norms is shown in Graph V. It brings out strikingly the difference in superiority in the reading rate of pupils who have received training in rapid effective silent reading and pupils who have been nurtured on the conventional *pabulum* of drill in oral reading. The superiority of the experimental pupils in every grade is very marked. Not less noticeable is the superiority over the norms reported by W. S. Gray and by Oberholtzer, as shown in Graph VI. The norms reported by Gray for the three different selections in his reading test have been adjusted here to the basis of the easiest selection, "Tiny Tad."

The highest norms reported are those by Brown. They represent, however, not the averages of all the pupils tested in the different grades, as in the case of the other investigators, but the highest averages reached by various single classes tested by Brown. Consequently they are offered as norms or standards to be striven after rather than indices of the present average attainment of the different grades. These standards mentioned by Brown come closer to the averages actually reached by the experimental classes than those of any of the other investigators. They are, however, very considerably below them, as shown in Graph VII.

The present norms for reading rate have all been

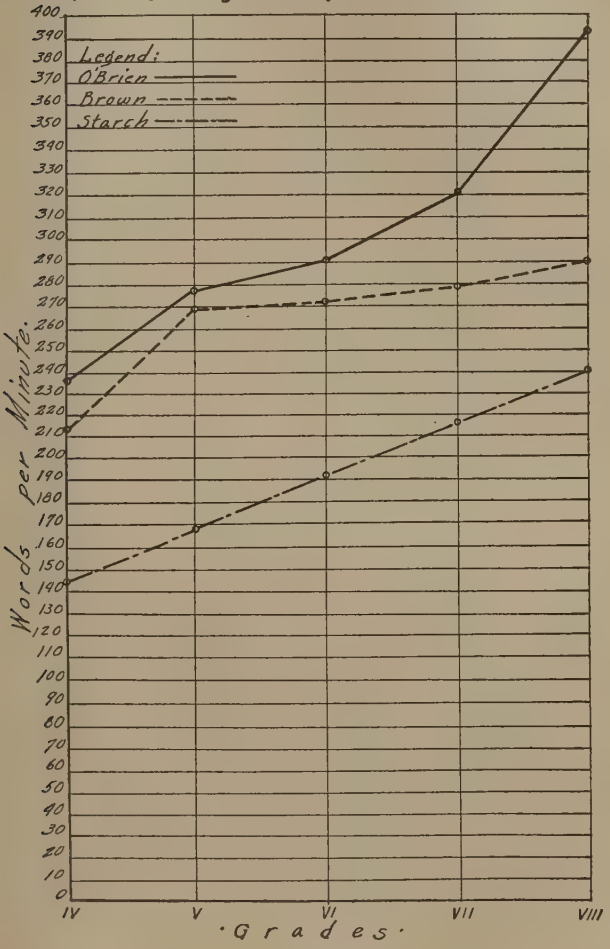
No. VI

Graph Showing
Average Rate for Pupils after training in Rapid Reading as compared with Norms Reported by Oberholtzer & Gray for Ordinary Readers.



No. VII

Graph showing
Average Rate for Pupils after
Training in Rapid Reading as compared with Norms
Reported by Brown & Starch for Ordinary Readers.



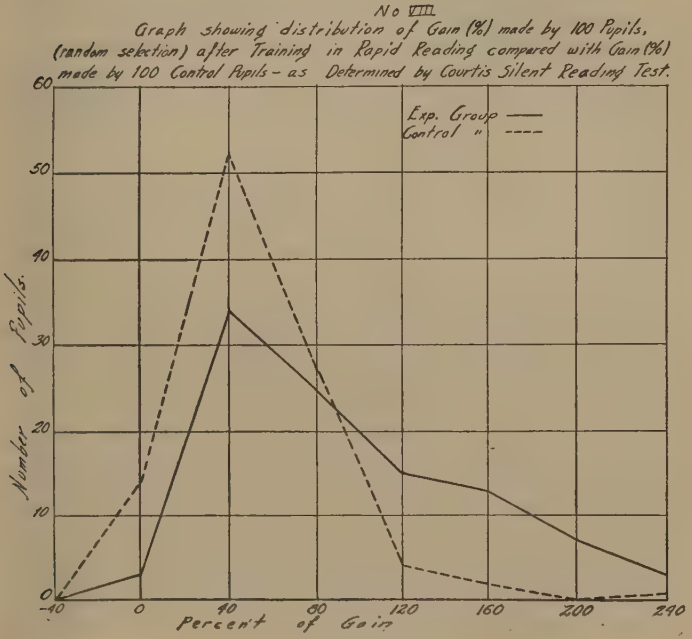
derived from the performances of pupils who have been trained in the conventional type of oral reading. In the vast majority of cases they have received no training in rapid silent reading. What the norms will be after the schools begin to train in rapid silent reading is an interesting question which the future alone can answer. As the result of a pioneer effort in a virgin field, the smoothed averages attained by the experimental pupils in the different grades in the present investigation are suggested as tentative norms. The degree of reliability of the averages for the different grades has been computed in terms of the P. E.[1] which are presented in Table XXVI. It is noted that the P. E. is relatively small, indicating a rather high degree of reliability for the averages.

Variability in the Amount of Gain in Rate

To show the range or variability in amount of gain in rate of the experimental pupils compared with the control pupils, Graph VIII is offered. A hundred pairs

[1] P. E. refers to the "probable error." As Whipple observes, "The term probable error is often a source of confusion to those unfamiliar with its use in mathematics. For a descriptive term, we might call it the 'median deviation,' since it is that deviation that is found midway from the representative value in either direction. The magnitude in question is not, of course, the *most* probable error, neither is it, in a certain sense, a 'mistake.' It is rather a 'probable sampling error': we are unable to measure every possible instance of the thing we are studying, but must content ourselves with a restricted number of samples, usually so taken as to be 'random samples.' The P. E. serves to indicate the reliability of these random samples, the degree to which they probably depart from the true universal values."

of pupils, each pair consisting of one experimental and one control pupil, were selected at random from a much larger list containing the pairs of pupils whose initial scores in rate were approximately equal. To facilitate comparison, the gain of each pupil was expressed as a per cent of his initial score. Graph VIII shows that the gains of the experimental pupils are grouped much more closely to the ordinate than the gains of the experimentals. The larger gains are made almost entirely by the latter group.



Measurement of the Comprehension by the Number of Questions Correctly Answered

As mentioned previously, the Courtis Index of Comprehension is a measure merely of accuracy. It does not reflect in any way the number of questions answered. Now obviously efficiency in comprehension consists not only in accuracy but in the number of actions correctly performed. To measure this latter phase of comprehension, which entirely escapes the Courtis Index, the number of questions correctly answered was employed as a supplementary measuring device. Indeed, unpublished data at the Bureau of Educational Research at the University of Illinois show that a higher correlation exists between the scores in comprehension as determined by other standard reading tests and the number of questions correctly answered, than between the comprehension scores in other tests and Courtis' Index of Comprehension.

The increase in the number of correct answers reflects furthermore the *increase in the rate of reading* of a passage in which the comprehension is required and on which it is tested. This device makes it possible, moreover, to determine whether or not the increased speed of reading effected by the training persisted in different situations. For the mental attitude assumed in reading a passage to answer questions on it immediately is considerably different from that assumed in reading a passage rapidly, simply "to get the gist"

of it. It is thought that the employment of this device in the present study obviates the one serious weakness inherent in the Courtis Reading Test. The performances of 247 experimental pupils selected at random from different grades were subjected to this sort of analysis. The results are presented in Table XXVII.

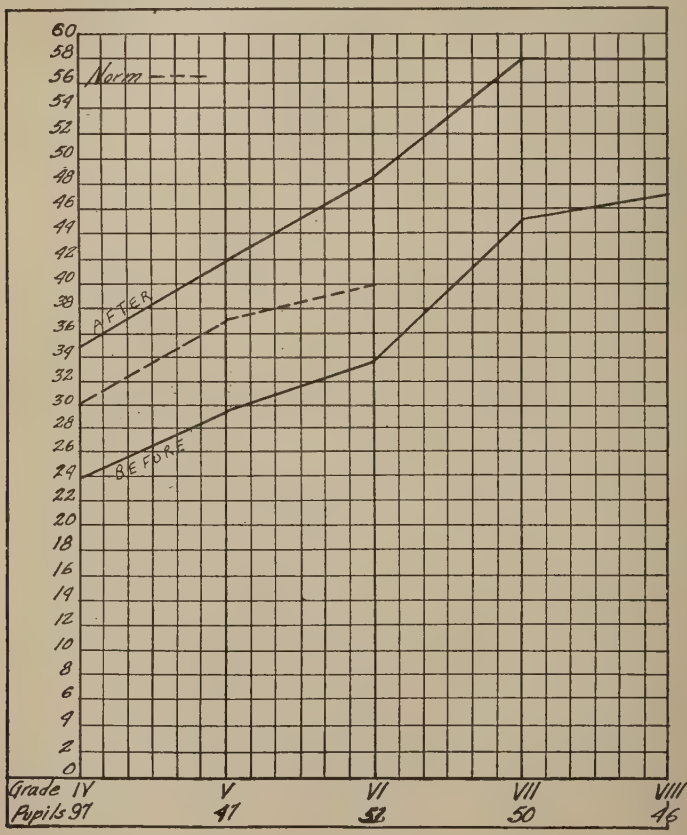
A very marked increase is shown in the number of questions correctly answered by the experimental pupils in all the grades. In fact, the number of *questions correctly answered* by the pupils after receiving the training in rapid reading is greater than the norms or average *number of questions attempted* as reported by Courtis. The average number of correct answers for the fourth grade as shown in Table XXVII is 34.8 as against Courtis' norm of 30 questions attempted; for the fifth grade it is 42.1 as against 37; for the sixth grade, 48.4 as against 40. No norms have been suggested by Courtis for the seventh and eighth grades. The average number of questions correctly answered by the different experimental classes at the beginning and end of the training are compared in Graph IX with the norms reported by Courtis for the number of questions attempted, whether answered correctly or not.

The conclusions that would seem to follow from this phase of the investigation are these:

1. Marked improvement in the efficiency of the comprehension resulted from the training, as shown by the gain in the number of questions correctly answered.

No. IX

Graph showing the Average Number of Questions answered correctly in Courtis Silent Reading Test by each pupil before and after training in Experimental Group Grade IV to VIII compared with Norms Reported by Courtis



2. This phase of the efficiency of comprehension is measured in no way by Courtis' Index of Comprehension, which is, more strictly speaking, an index of accuracy.

3. The marked gain in the number of questions correctly answered demonstrates the persistence of the improvement in reading rate in a changed situation involving a different mental attitude — *i.e.* in careful reading for the purpose of answering written questions.

Comparison of the Results of Method I and Method II

Which type of training — No. I. Training in Rapid Silent Reading or No. II. Training to Decrease Vocalization in Silent Reading — proved the more effective? As was stated in the previous chapters, these methods are substantially the same — the chief difference being a difference of stress. In the latter method the attempt to decrease vocalization in order to improve the rate of reading is made a conscious problem. In Method I the suppressing of the elaborate vocalization is accomplished indirectly, by directly emphasizing speed in reading. Not much difference in the results was expected. The results show even less than was expected.

In the fourth grade, Type I shows a slight superiority in average gain — 4.1 words per minute; in grade five the advantage, 15.9 words per minute, rests with Type II. A comparison between the gains made by a number of sixth-grade pupils using Type II with the gains made

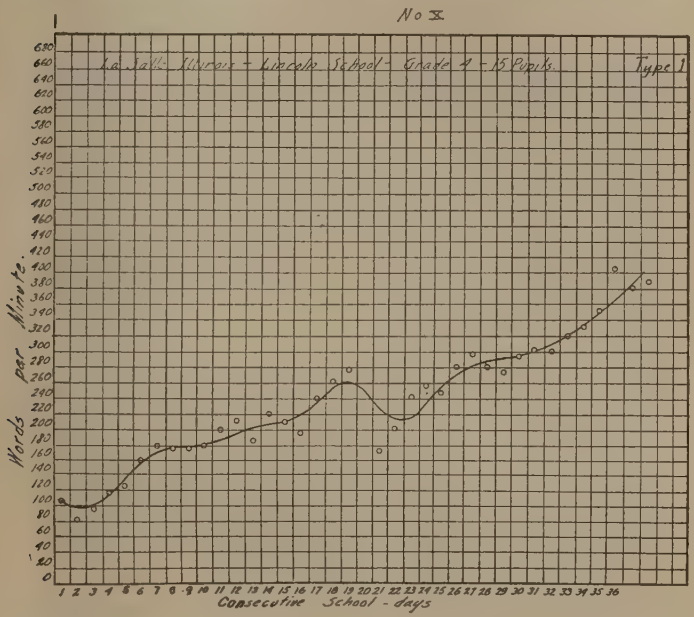
by a number of seventh-grade pupils employing Type I shows that, in point of absolute gain, Type I has a slight superiority — 11.6 words per minute. In the amount of gain made over the corresponding control groups, however, the advantage, 14.9 words per minute, rests with Type II. These results would seem to indicate that the two types of training, because substantially the same, are practically equal in effectiveness.

The Growth of Speed in Silent Reading as Shown by the Class Charts

The measurement of the increase in rate in this study was based not only upon the results of the Courtis Silent Reading Test, but also upon the daily class charts. The daily progress of each experimental pupil was recorded on his individual graph by showing the average number of words read per minute during the total reading period on each day of the training period. The median rate of reading for each day was placed on the class chart, which thus reflected the progress of the whole class. The fact that the class chart records the progress for each day, enables it to reflect the character of the growth in speed, gradual or otherwise, which the three Courtis Tests naturally could not show.

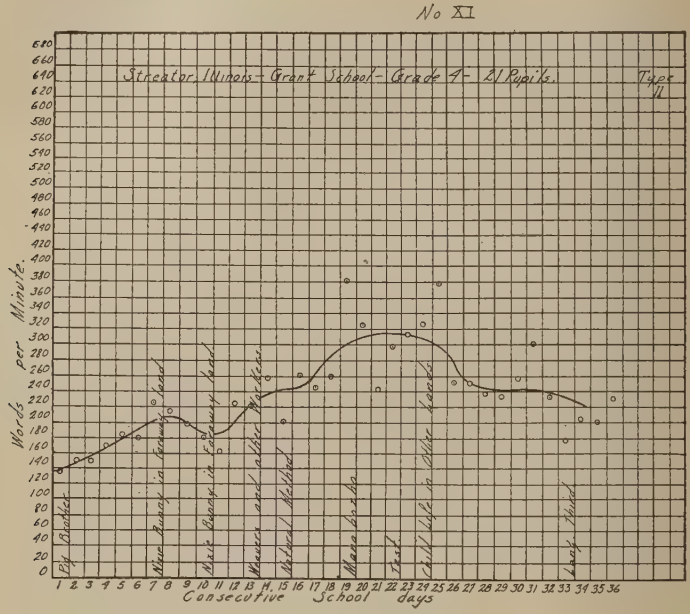
A number of class charts showing the kinds of growth in speed are presented for each grade. Graph X, showing the progress of the experimental group in the fourth grade in the Lincoln School at LaSalle, reflects a fairly regular growth. The only appreciable break in the

continuity of advancement occurs during approximately the middle of the training period. The curve of improvement shown in Graph XI reveals considerably more fluctuations. Many of the irregularities in the curve can be explained by the changes in the subject



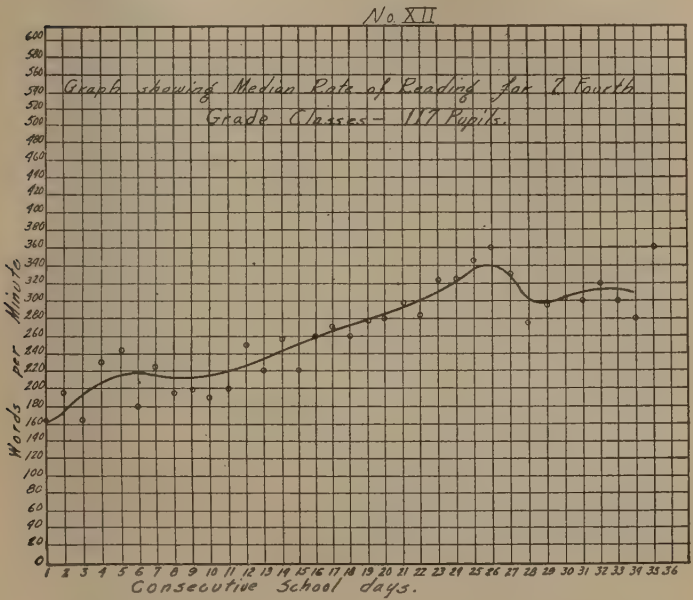
matter to be read. The reading books on which the rates of speed were made are indicated in the graph. The median growth in speed for the seven fourth-grade classes comprising 117 pupils is shown in the composite Graph XII. The curves are smoothed in all the graphs. The dots represent the actual averages from

which the curves were smoothed. The median growth in speed for the fourth-grade classes is on the whole quite regular. The median increase is from 163 words per minute to 310.



The curves of progress for two fifth-grade classes are shown in Graphs XIII and XIV. The markedly irregular curve of progress in the latter graph contrasts with the general smoothness of the composite chart shown in Graph XV. The increase is somewhat more marked than in the fourth grade — being from 183 to approximately 378 words per minute.

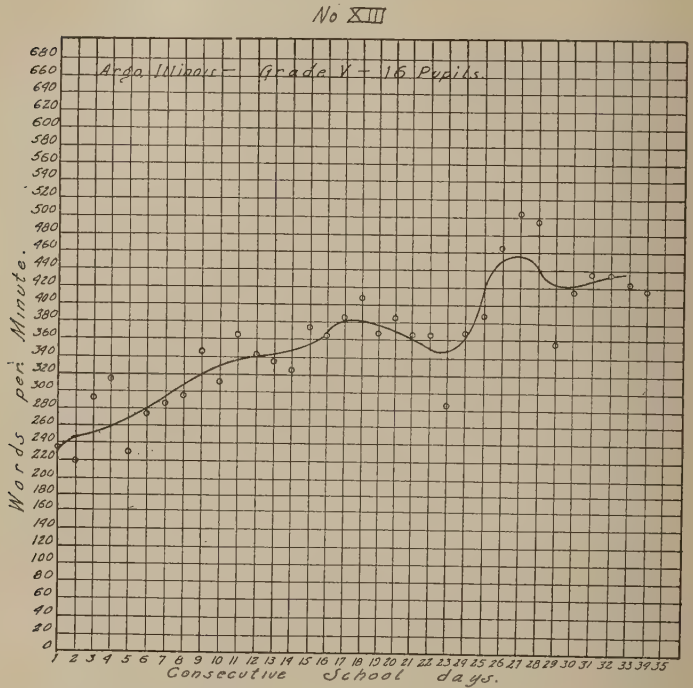
In the curve of progress at St. Mary's School as shown in Graph XVI, it is to be noted that the growth in speed is much more marked in the latter than in the first half of the training period. The median growth of three


No. XII
Graph showing Median Rate of Reading for 7 Fourth Grade Classes — 117 Pupils.
Words per Minute
Consecutive School days.

sixth-grade classes is shown in the composite Graph XVIII. The curve is not so regular as in the previous composite graphs.

The curves in Graphs XIX and XX manifest minor fluctuations, though the central tendency of progress is strongly in evidence. The composite Graph XXI

showing the growth of seven seventh-grade classes comprising 119 pupils displays more smoothness. The increase is from 220 words per minute to approximately 490. In the composite Graph XXIII of the three



eighth-grade classes, the steep upward slope of the curve is more marked than in any of the previous composite graphs. Moreover, the increase is consistent, and there is no indication that in this the highest grade im-

provement might not continue to an indefinite extent if the practice period had been longer.

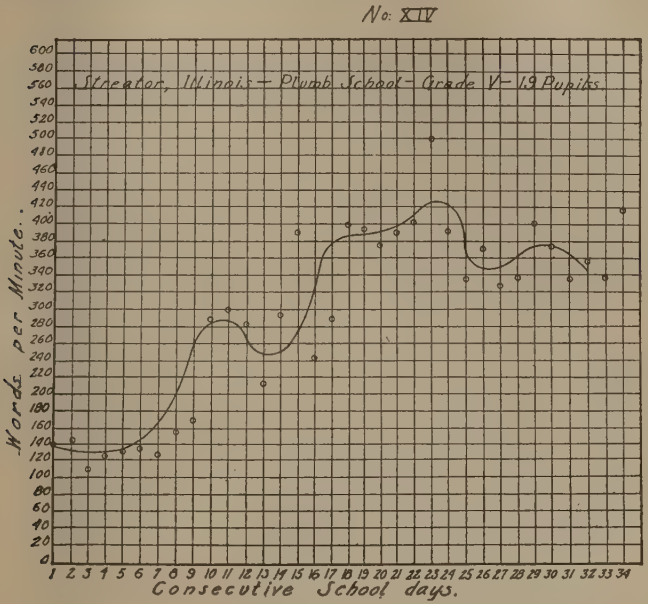


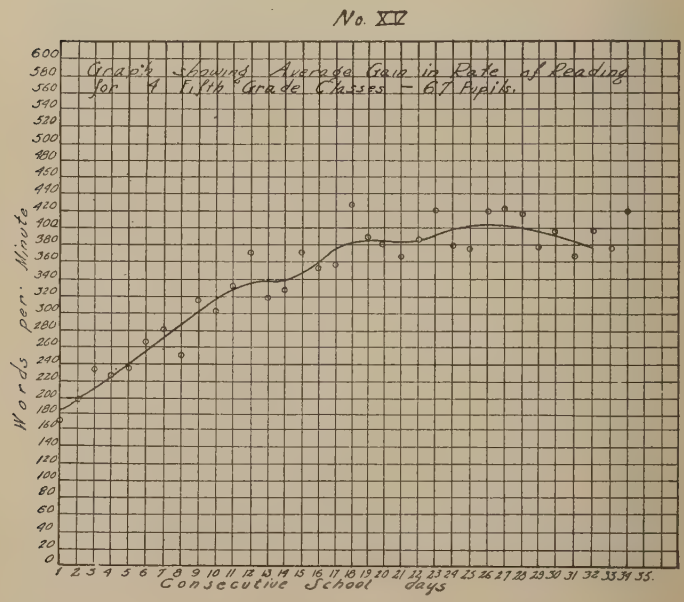
TABLE XXVII. GAIN IN COMPREHENSION OF THE EXPERIMENTAL PUPILS AS DETERMINED BY THE NUMBER OF QUESTIONS CORRECTLY ANSWERED IN COURTIS TESTS

GRADE	NUMBER OF PUPILS	BEGINNING	END	GAIN
IV	97	23.9	34.8	10.9
V	47	29.6	42.1	12.5
VI	57	33.7	48.4	14.5
VII	50	45.3	58.0	12.7
VIII	46	47.1	57.8	10.7

TABLE XXVIII. COMPARISON OF GROWTH OF SPEED IN SILENT READING OF 23 CLASSES IN DIFFERENT GRADES, AS DETERMINED BY THE COURTIS TESTS WITH THAT RECORDED ON THE CLASS CHARTS

	BEGINNING	END	GAIN	PER CENT OF GAIN
Courtis Tests . . .	189	295	106	56%
Class charts	228	411	183	80%

Table XXVIII is to be read thus: At the beginning of the training the median rate of speed of the 23 classes as determined by the Courtis Tests was 189 words per minute, 295 words at the end of the training. The median gain in number of words per minute was 106, the median gain in per cent was 56%.


No. XV
Graph showing Average Gain in Rate of Reading for 4 Fifth Grade Classes – 67 Pupils.
Words per Minute
Consecutive School Days

No. XII

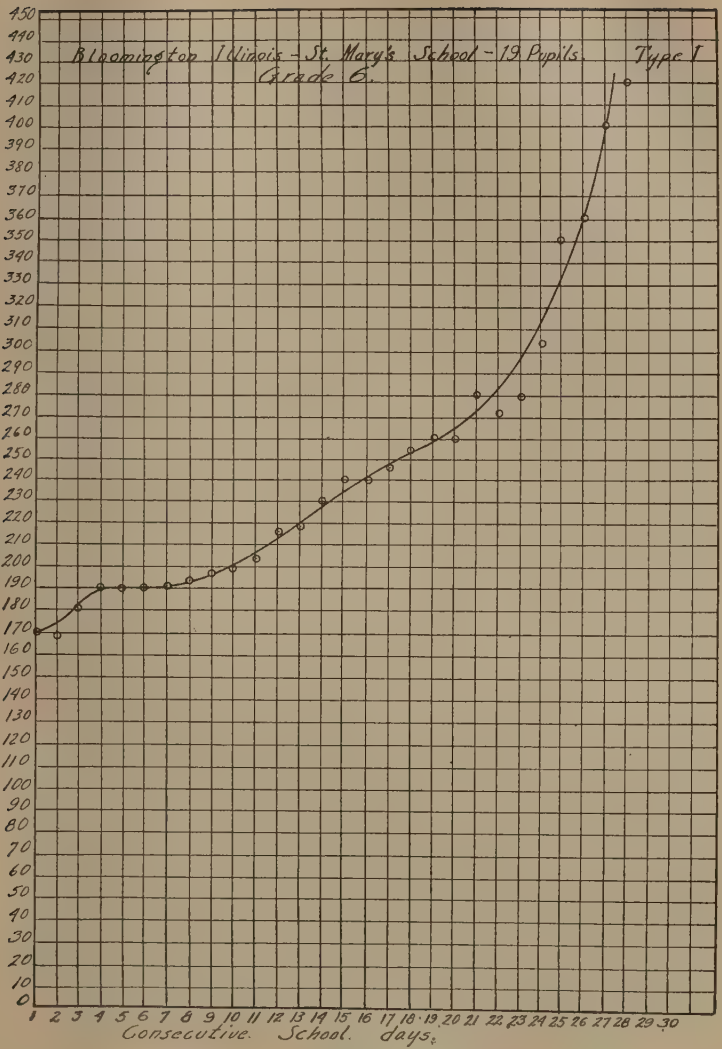

Bloomington Illinois - St. Mary's School - 19 Pupils. Type I
Grade 6.
Words per Minute
450 440 430 420 410 400 390 380 370 360 350 340 330 320 310 300 290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Consecutive School days.

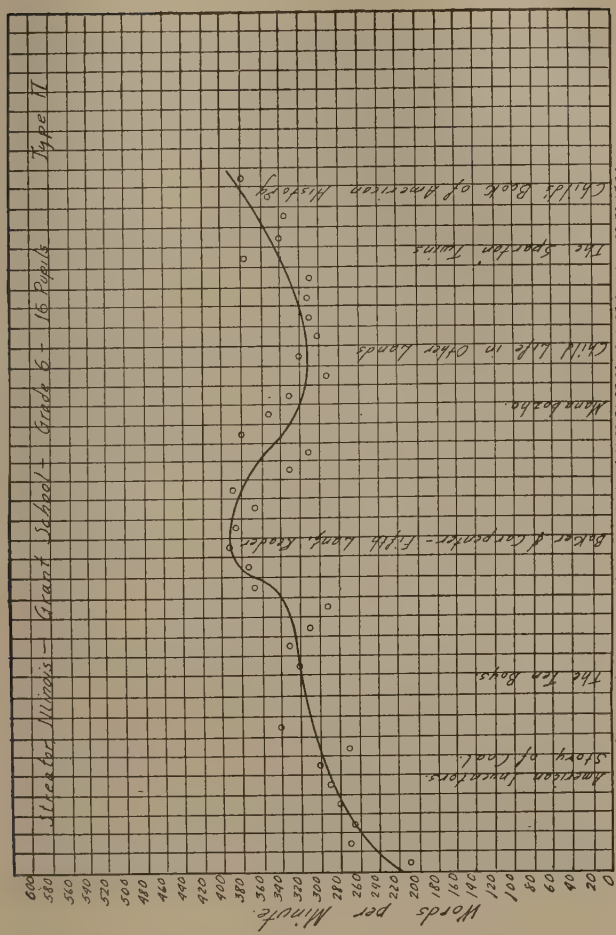
TABLE XXIX. THE AVERAGE READING RATE OF BOYS AND GIRLS AT THE BEGINNING AND END OF THE EXPERIMENT AND THE RELATIVE AMOUNT OF GAIN

GRADE	BOYS			GIRLS			AVERAGE GAIN		GIRLS' SUPERIORITY IN	
	No. of Boys	Beginning	End	No. of Girls	Beginning	End	Boys	Girls	Final Ave.	Gain
III .	12	137	231	11	152	254	94	102	23	8
IV .	49	144	220	53	157	234	76	77	4	1
V . .	27	154	276	22	170	266	122	96	−10	−26
VI .	19	192	288	32	196	289	96	93	1	−3
VII .	38	195	315	64	210	326	120	116	11	−4
VIII .	21	228	435	24	211	351	207	140	−84	−67

Table XXIX is to be read for grade 3 as follows: 12 boys had an average rate of 137 words per minute at the beginning of the training, 231 words at the end; 11 girls averaged 152 at beginning, 254 at end; boys' gain was 94 words per minute, the girls' was 102; the superiority of the girls' final average over the boys' final average was 23, the girls' superiority in gain over the boys was 8 words per minute.

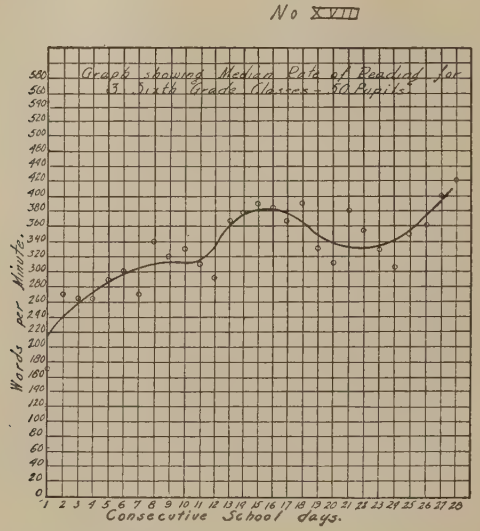
Table XXVII compares the median rate of speed of 23 classes in various grades as determined by the Courtis Reading Test with that shown by the class charts. The table shows that the amount of increase in speed as recorded on the class charts for the different grades is greater than that manifested by the Courtis Tests. This is due to the greater stimulation, the greater pressure, that was brought to bear upon the pupils in the regular daily training in rapid reading. The pressure of the individual graph and of the class chart was not applied to the reading of the Courtis Test.

In Graph XXIV are shown the rates of all the grades


No. XVII
Standard Illinois — Grant School — Grade 6 — 16 Pupils Type II
Words per Minute.
Consecutive School days.
American Inventors. Story of Coal.
The Ten Boys.
Boyer & Carpenter. Fifty Hard Knots.
Moonbeam.
Child Life in Other Lands
The Spartan Twins
Child's Book of American History

at the beginning and at the end of the experimental training as recorded on the class chart. The shaded blocks in the graph call attention to the amount of gain in rate made by the different grades.

In short, the results of the class charts offer a rather

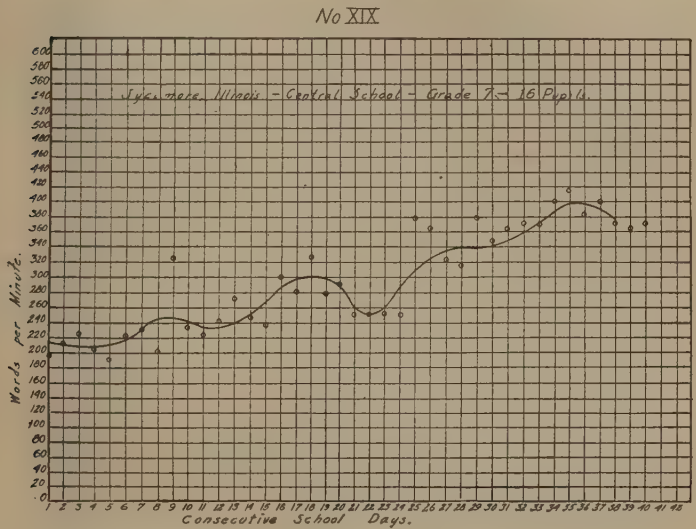

No XVIII
Graph showing Median Rate of Reading for 6 Sixth Grade Classes - 80 Pupils
Words per Minute.
Consecutive School days.

striking corroboration of the general conclusions drawn from the data afforded by the Courtis Test.

Correlation of Rate of Reading with Simple Reaction Time and Discrimination Reaction Time

The attempt was made in the present investigation to ascertain the correlation between the reading rate and the rates of simple motor reaction and discrimina-

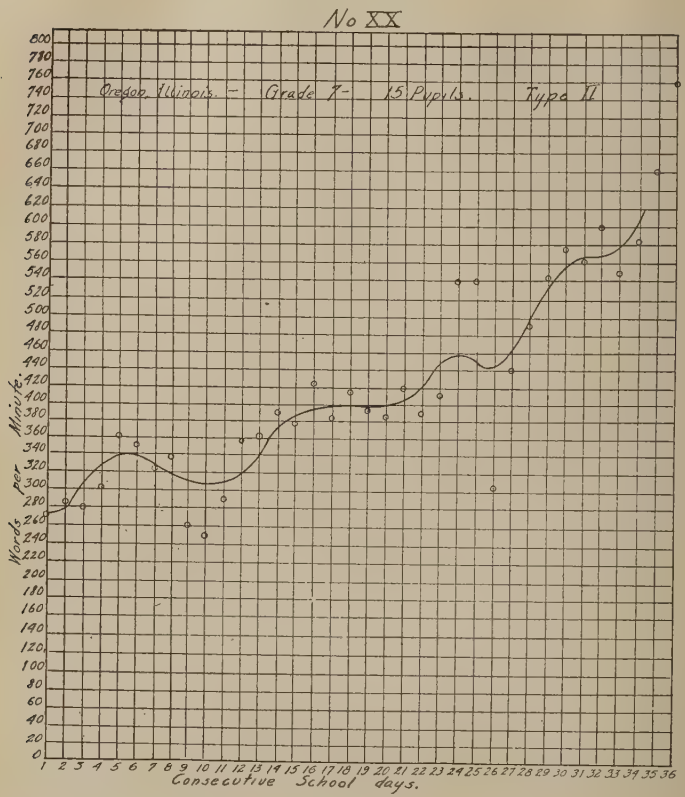
tion reaction. The test for simple reaction was the cancellation test A–3 described by Whipple in his Manual of Mental and Physical Tests. As used in this experiment, the pupils were requested to cross out *all* the geometrical figures, instead of only certain ones. The discrimination reaction test called for the



canceling of only the numeral 9 in lines containing various digits. These tests were administered to the pupils in the fourth and fifth grades in the Goodrich School, whose rates of reading had been previously measured by the Courtis Test.

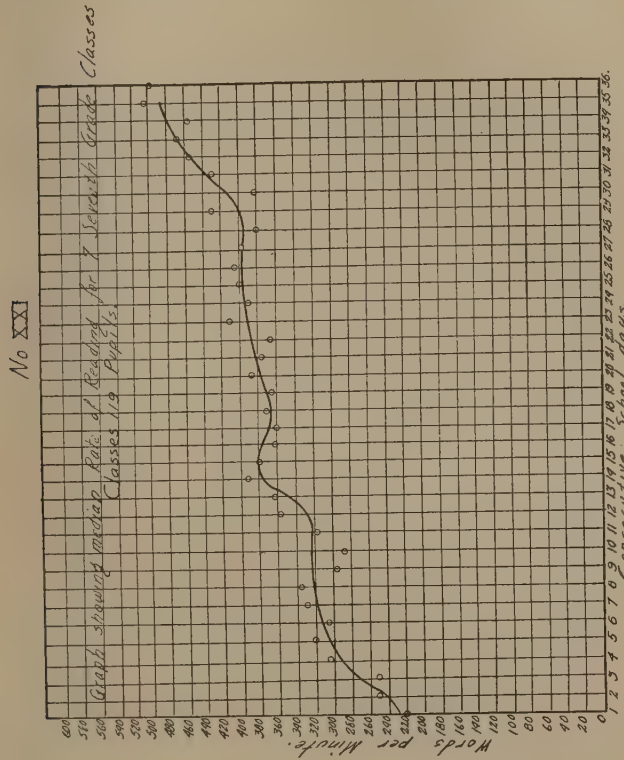
The correlation between the rate of reading and simple motor reaction was found to be rather low —

r being .214 for the fourth grade and .228 for the fifth. The coefficient of correlation between the rate of read-



ing and the rate of discrimination reaction was computed for the pupils of the fourth grade. The correlation in this case was found to be somewhat higher —

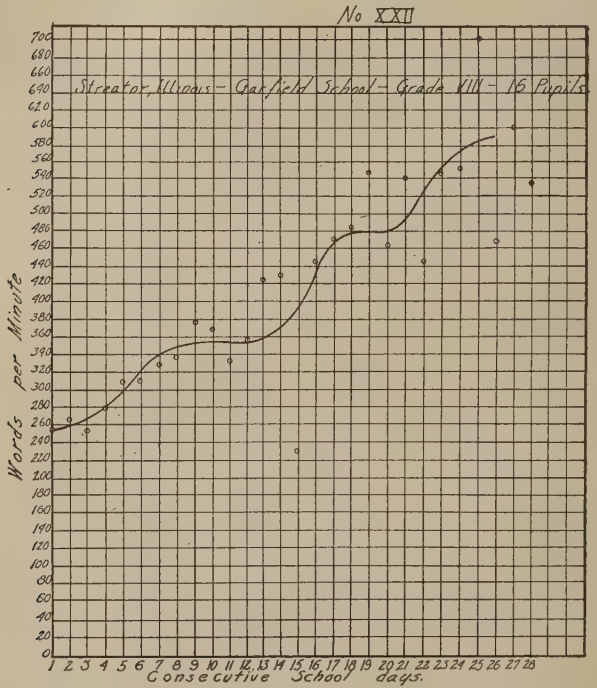
r being .435. On the whole, the coefficients are too low to indicate the existence of any very significant positive correlation between the reading rate and the rate


No XXI
Graph showing median Rate of Reading for 7 Seventh Grade Classes 119 Pupils
Classes
Consecutive School days.
Words per Minute.

of either simple motor or discriminatory reaction, though the correlation is certainly more in evidence in the latter case.

The Work Curve for One Reading Period

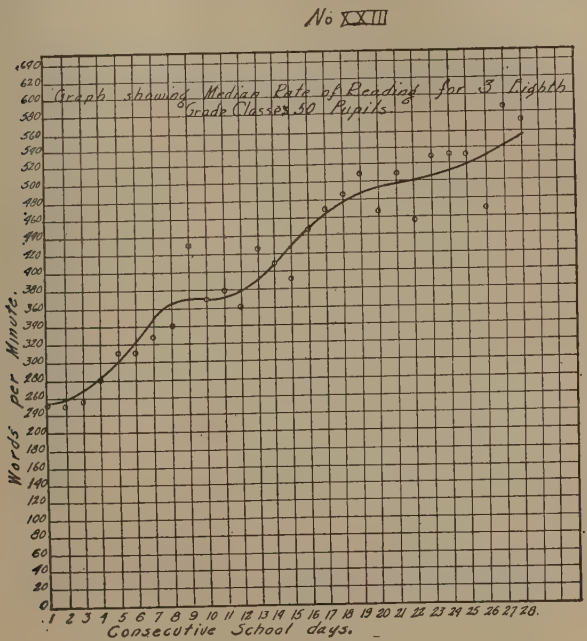
Besides determining the average number of words read per minute by each pupil for each of the total reading periods of, say, 20 or 25 minutes during the



experiment, two days were specified on which more detailed measurements were requested. The pupils were asked to record the number of words read per minute during each of the several briefer stretches

constituting the total reading period for the day. This was done in an effort to determine the daily work curve for reading.

A study of the work curves of the various classes shows there is no uniform type of curve. Variability

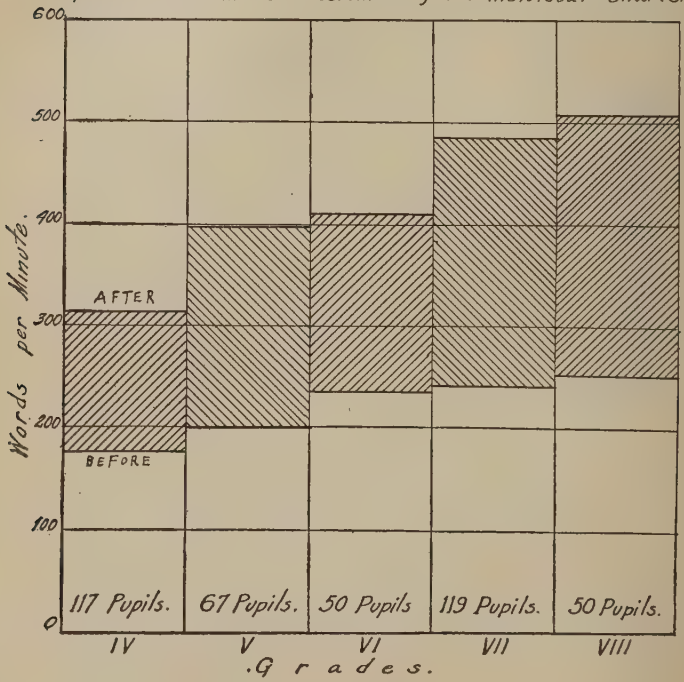

No XXIII
Graph showing Median Rate of Reading for 3 Eighth Grade Classes 90 Pupils
Words per Minute.
Consecutive School days.

is the striking characteristic. In some classes, pupils read at maximal rate in the middle stretches, in others, toward the end, while in still other classes, pupils reached their highest rate in the second and third stretches. These results would seem to support the

conclusion of Thorndike that there is no uniform type of work curve, with clearly defined characteristics, re-

No. XXIV

Graph showing the Average number of Words Read per Pupil before and after Training in Grades IV to VIII as determined by the individual charts.



vealing the successive occurrence of "initial spurt," "warming-up" (*Anregung*), "adaptation" (*Gewöhnung*),

and the other processes which Rivers and Kraepelin, and especially Offner, have predicated of work curves in general.

The Factor of Sex

Table XXIX shows that the average rate of the girls is slightly higher than that of the boys. At the beginning of the training the average rate for the girls was higher in every grade except the eighth; at the end of the training in every grade save the eighth and the fifth. In amount of gain as a result of the training the boys somewhat surpassed the girls. The training in rapid reading was rather intensive and somewhat strenuous and it is possible that the neuro-muscular system of the boys enabled them to profit by it slightly more than the girls. Both sexes, however, showed very marked gains in rate in all the grades and the differences in the amount of gain made by the two sexes are too slight to be of any special significance.

CHAPTER X

PHOTOGRAPHIC RECORDS OF EYE-MOVEMENTS DURING READING

A STANDARDIZED silent reading test is doubtless capable of measuring the rate of reading satisfactorily. It can determine the increase or decrease in speed effected in a given time. Behind that simple factual statement, however, a reading test does not penetrate. It tells nothing about the factors which lie behind that increase or decrease in rate — nothing about the causes — proximate or remote. In the present investigation an effort was made to penetrate behind the simple determination of increase in speed, as shown by the Courtis Silent Reading Test and the individual charts, into the nature of the modifications of the physiological factors which accompanied the increase in rate. In other words, how is an increase in speed to be explained in terms of the physiological processes constituting the reading complex?

Is the habit of increased speed achieved chiefly by the shortening of the duration of the fixation-pauses? Or by a lessening of their number? Or by a combination of both these results? This Schmidt (18) char-

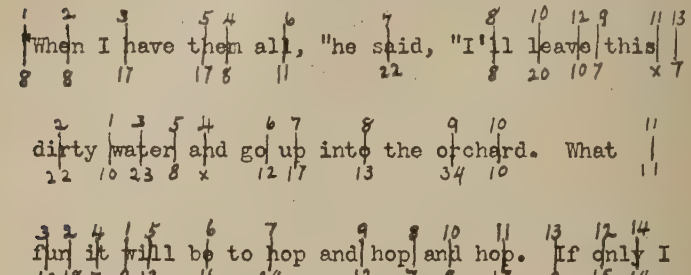
acterizes as one of the "interesting, but as yet unsolved problems" in the psychology of reading. What, moreover, are the changes in the character of the eye-movements of an individual who has developed from a slow to a rapid reader? Have the movements become more regular and rhythmical, or the opposite? Has the acquirement of the habit of increased speed resulted in an increase in the number of regressive movements — which are signs of mental confusion — or have they decreased? Is the rate of the inter-fixation movements and the interlinear "sweeps" affected by the habit of increased speed in reading?

These are some of the interesting questions which have been broached in recent studies in the technical psychology of reading. In the present investigation the attempt was made to secure some data for the formulation of at least tentative answers to the above queries.

For this purpose, photographic records were taken of the eye-movements of ten pupils while they were engaged in silent reading. These ten pupils, five boys and five girls, representing various degrees of silent reading ability, were selected from the classes in the Goodrich, Hendricks, and Manierre schools in Chicago, which were receiving training in rapid reading as outlined in Type I and Type II. The elaborate photographic apparatus, the evolution of which was mentioned in Chapter I, and which has been recently improved upon by Judd, C. T. Gray, Freeman, Schmidt,

and others at the University of Chicago, was used in this connection. Records were taken both before and after the training in rapid reading.

PLATE I. SILENT READING BY A. P., A FOURTH-GRADE SUBJECT —BEFORE TRAINING

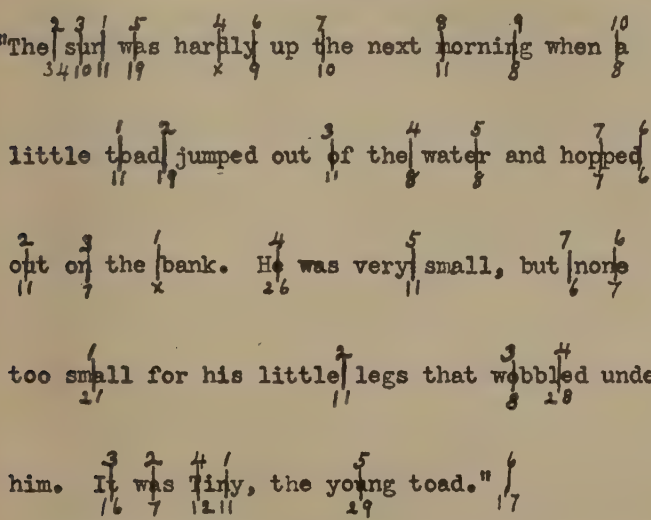

'When I have them all, "he said, "I'll leave this
dirty water and go up into the orchard. What
fun it will be to hop and hop and hop. If only I
had a little brother to hop with me, I should be
so happy."

X indicates that it was impossible to determine with accuracy the duration of the fixation-pause. The vertical lines indicate the position of the eye's fixation; the numbers at the top of the line show the order in which the fixations occurred. The numbers at the bottom of the line give the duration of each fixation in fiftieths of a second. Thus Plate I is to be read: The first fixation occurred on the quotation mark (') before the word "when"; its duration was $\frac{8}{50}$ of a second; the second fixation was on the letter "e" in the word "when"; its duration was $\frac{8}{50}$ of a second.

In order that comparisons might properly be made between the eye-movement records of pupils in different grades, it was necessary to secure subject matter which was adjusted to the comprehension of the differ-

ent grades, and which was of approximately equal difficulty for the pupils in each grade. The selections in Gray's Silent Reading Test — Tiny Tad, The Grasshoppers, Ancient Ships — having been carefully evaluated as to their degree of difficulty, proved well suited

PLATE II. SILENT READING BY A. P., A FOURTH-GRADE SUBJECT — AFTER TRAINING


"The sun was hardly up the next morning when a
little toad jumped out of the water and hopped
out on the bank. He was very small, but none
too small for his little legs that wobbled under
him. It was Tiny, the young toad."

X indicates that it was impossible to determine with accuracy the duration of the fixation-pause.

for this purpose. Different passages in the various selections were used at the beginning and at the end of the training, so that, in no case, was the complicating factor of special familiarity with the specific subject matter introduced. The instructions given to the

pupils before reading Gray's test at the beginning and at the end of the training period were substantially the ones which preface every standardized silent reading test — "Read only as rapidly as you can understand what you are reading."

The situation in which the pupils read while their eye-movements were being photographed was naturally considerably different from the one to which they were accustomed in the classroom. The room was darkened, the selection alone being illuminated. A ray of light was reflected into the subject's eyes, thence into the lenses of the camera. The head of the subject was prevented from moving by means of a headrest. The latter had four points of contact — one at the forehead, one at the back, and two at the cheeks. After it was adjusted, the subjects did not find it especially disturbing. A few of the younger subjects seemed to find the situation quite amusing, as shown by their smiles.

I. Eye-Movement Records of Fourth-Grade Subjects — Before and After Training

1. *A Slow Fourth-Grade Reader*

Plate I shows the record of A. P. before receiving the experimental training. A. P. is a ten-year-old boy in the fourth grade in the Goodrich School. His general class average is rated by the teacher as "fair," his oral reading as "poor." His rate in silent reading

was only 73 words per minute as measured by the Courtis Silent Reading Test; his comprehension was very low. He ranked among the lowest in his class in both rate and comprehension. He is of foreign-born parentage. His father does not speak English, though his mother does.

The record in Plate I reflects very clearly the physiological factors back of the pupil's deficiency in reading. The number of fixations is excessively large; regressive movements are too numerous. Not a single line is without them. They show traces of unmistakable confusion in the interpretation of the printed symbols. They indicate that the reader was obliged to go back frequently to previous words in order to get the meaning of the present word or phrase. Regular rhythmical eye-movement habits are conspicuous by their absence. The visual span is very narrow. Thus, in line 2, the short word "water" receives three fixations. In line 3 there are four backward or regressive movements.

The record in Plate II for A. P. after training shows considerable improvement over the subject's previous performance. Two months of the experimental training of Type II had effected a marked increase in speed. His record on the Courtis Test showed that he had more than doubled his rate, while his comprehension had likewise improved. The amount of pressure that was brought to bear upon the pupils to increase their rate in the regular reading period in the school was

naturally not applied to their reading before the camera. Under the novel circumstances under which the latter was done, and the very brief interval allowed, it is doubtless true that the subjects did not reach as rapid a pace as they did in reading the Courtis Test under normal classroom conditions. Nevertheless, the second record of A. P.'s reading shows that the training had produced a marked decrease in the number of fixation-pauses per line, as well as a decrease in the number of regressive movements from 17 to 9 — a decrease of almost 50%.

Table XXX gives a detailed comparison of the two complete records of A. P.'s reading. Only samples of the complete record were presented in Plates I and II.

The decrease in the average number of fixation-pauses from 11.7 to 7.8 per line — a decrease of almost 4 per line — is probably the most striking modification in the motor behavior of the eyes which the photographic records evince. It shows clearly that the experimental training was effective in widening the visual span which functioned in the pupil's reading. The teacher reports that the interest displayed by this subject in training was "intense." At the beginning of the training, his silent reading was accompanied by elaborate lip-movement. After about one month's training, the lip movement disappeared. Throat-movements persisted for about two weeks longer, after which time they could no longer be detected by the teacher. The data

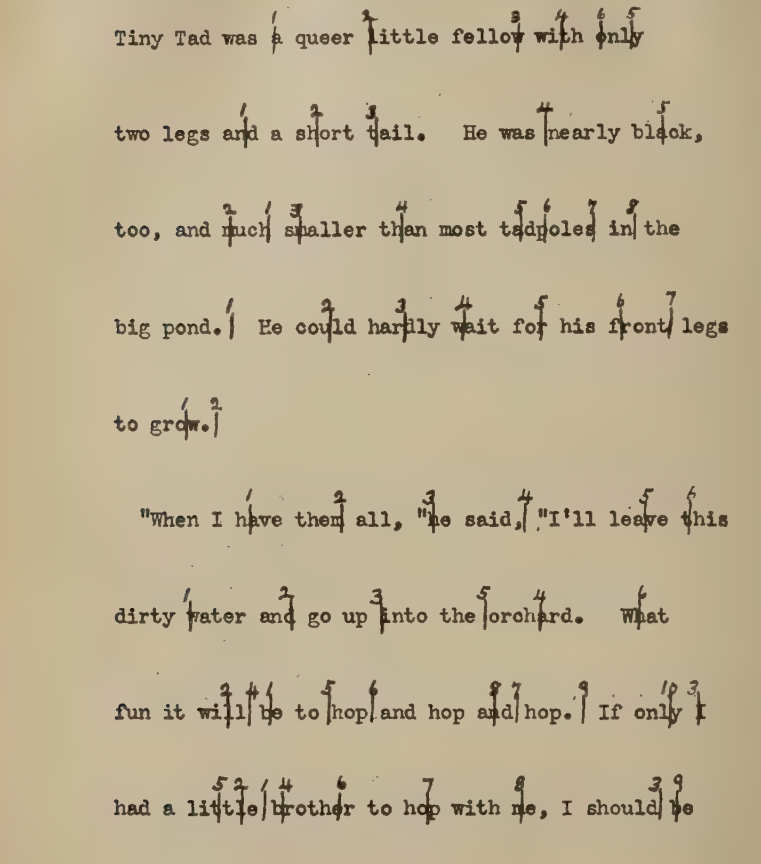
from the photographic records, the Courtis Test, the individual chart, and the teacher's observations — all combine to show that the training of Type II proved very effective in improving the reading ability of this subject to a marked degree.

TABLE XXX. COMPARISON OF THE EYE-MOVEMENT RECORDS OF A FOURTH-GRADE SUBJECT, A. P. — BEFORE AND AFTER TRAINING IN RAPID READING

LINE	NUMBER OF PAUSES		AVERAGE DURATION OF PAUSE		AGGREGATE DURATION OF PAUSE		NUMBER OF REGRESSIVE MOVEMENTS	
	Record		*Record*		*Record*		*Record*	
	I	II	I	II	I	II	I	II
1	8	9	13.0	10.9	104	98	1	0
2	9	18	14.4	12.5	130	100	1	0
3	15	8	12.3	15.8	185	126	3	1
4	13	12	11.7	12.8	152	153	3	2
5	11	10	16.0	13.3	176	133	2	2
6	14	6	12.5	10.0	175	60	4	0
7	12	7	12.9	11.3	155	79	3	1
8		4		17.0		68		0
9		6		15.3		92		2
Total	82	70	92.8	118.9	1077	909	17	9
Average	11.7	7.8	13.1	13.0	13.1	13.0	2.4	1.0

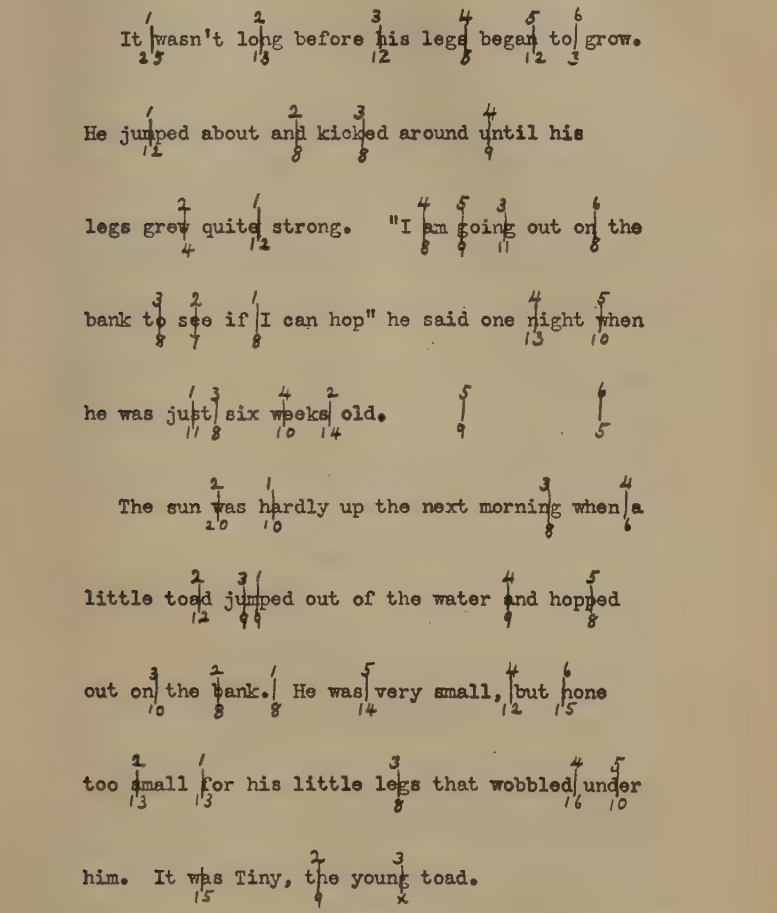
Table XXX should be read for line 1 as follows: In the first record there were 8 fixations, in the second, 9. The average duration of the fixation-pauses in the first record was 13 fiftieths of a second, in the second record, 10.9 fiftieths; the aggregate duration was 104 fiftieths of a second in the first record, 98 fiftieths in the second record. There was one regressive movement in the first record, none in the second record.

PLATE III. SILENT READING BY FOURTH-GRADE SUBJECT, N. C. — BEFORE TRAINING


Tiny Tad was a queer little fellow with only
two legs and a short tail. He was nearly black,
too, and much smaller than most tadpoles in the
big pond. He could hardly wait for his front legs
to grow.
"When I have them all," he said, "I'll leave this
dirty water and go up into the orchard. What
fun it will be to hop and hop and hop. If only I
had a little brother to hop with me, I should be
so happy."

Only the fixation-positions are marked. The subject was not in the exact focus, so the duration of the fixation-pauses could not be determined.

PLATE IV. SILENT READING BY FOURTH-GRADE SUBJECT, N. C. — AFTER TRAINING


It wasn't long before his legs began to grow.
He jumped about and kicked around until his
legs grew quite strong. "I am going out on the
bank to see if I can hop" he said one night when
he was just six weeks old.
The sun was hardly up the next morning when a
little toad jumped out of the water and hopped
out on the bank. He was very small, but none
too small for his little legs that wobbled under
him. It was Tiny, the young toad.

X indicates that it was impossible to determine with accuracy the duration of the fixation-pause.

2. *Record of a Rapid Fourth-Grade Reader*

Plate III shows the record of N. C. before training. N. C. is a nine-year-old girl in the fourth grade in the Goodrich School. The teacher reports that her general class average and her reading ability are "excellent." Her rate of reading as measured by the Courtis Test was 267 words per minute; her comprehension score was 75 per cent. The test confirmed the teacher's judgment and showed that the subject was, by far, the fastest reader in her class. She is of foreign-born parentage; her father speaks English but her mother does not. Her advancement through the grades has been normal. The subject manifested great interest in the experimental training.

The record in Plate III shows that N. C. is a superior type of reader for a fourth-grade pupil. The subject averages but 7.1 fixation-pauses per line. The regressive movements are not numerous, averaging but 1.1 per line. There is a fair degree of regularity and rhythm to the eye-movements, indicating a rapid rate on the part of the reader. Contrast Plate III with Plate I, and the superiority of N. C. over A. P. in practically every aspect of the reading process is made strikingly manifest.

Plate IV shows that N. C. despite her high initial ability also profited by the training in Type II. There is a decrease in the total number of fixation-pauses for the 8 complete lines in both records from 57 to 41 —

an average decrease of 2 fixation-pauses per line. The perceptual span has been widened so that it grasps a larger number of printed symbols in a single fixation. Thus, lines 2 and 6 are each grasped in 4 fixations, while the best performance on the previous record (Plate III) was the perception of line 2 in 5 fixations. The minimum for the other lines is 6, which is the maximum number of fixations required to read any line in Plate IV. An improvement in regularity and rhythm of eye-movement habits is also clearly noticeable. The Courtis Test likewise showed an increase in speed and a gain of 7 per cent in comprehension.

TABLE XXXI. COMPARISON OF THE EYE-MOVEMENT RECORDS OF A FOURTH-GRADE SUBJECT, N. C., BEFORE AND AFTER TRAINING IN RAPID READING

LINE	NUMBER OF PAUSES		DURATION OF PAUSES		NUMBER OF REGRESSIVE MOVEMENTS	
	Record		Record II		Record	
	I	II	Average	Aggregate	I	II
1	6	6	13.2	79	1	0
2	5	4	9.3	37	0	0
3	8	6	8.7	52	1	2
4	7	5	9.2	46	0	2
5	6	4	11.0	44	0	1
6	6	5	9.4	47	0	1
7	10	6	11.2	67	3	3
8	9	5	12.0	60	3	1
9					2	0
Total	57	41	84	432	10	10
Average	7.1	5.1	10.5	10.5	1.1	1.1

PLATE V. SILENT READING BY FOURTH-GRADE SUBJECT, M. L. — BEFORE TRAINING

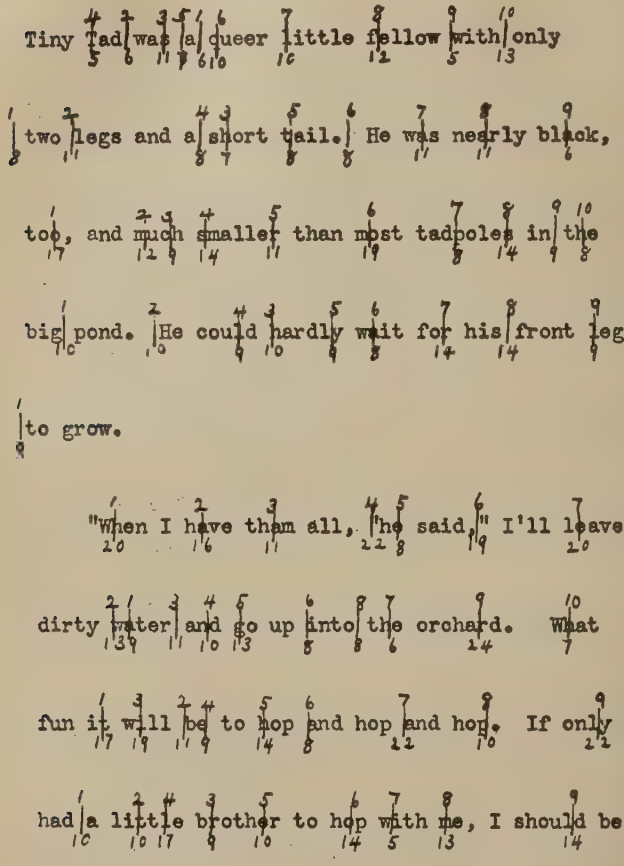
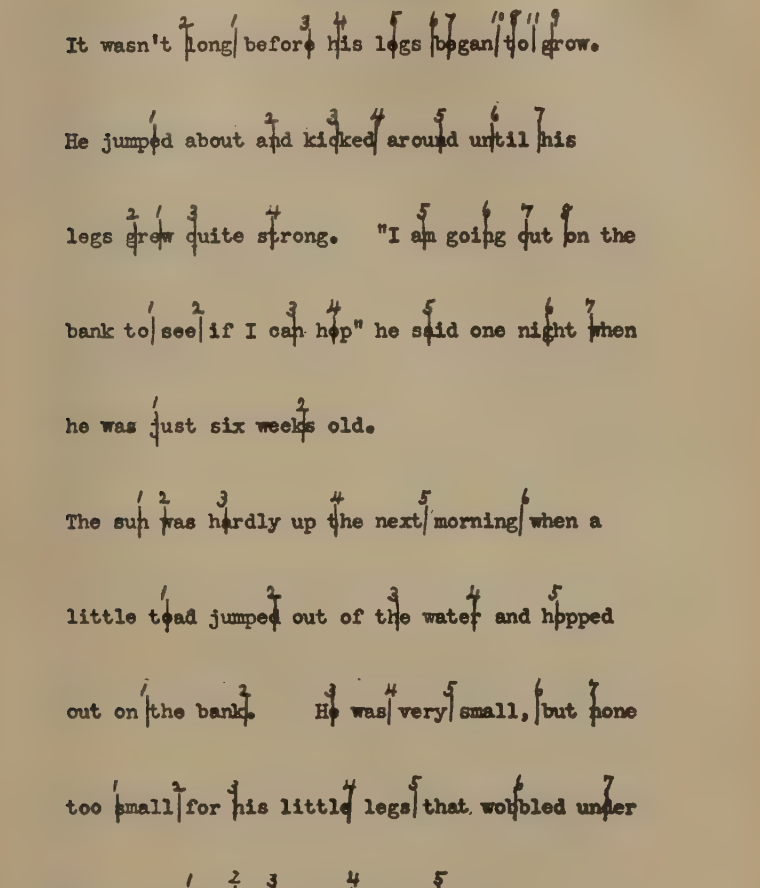

Tiny Tad was a queer little fellow with only
two legs and a short tail. He was nearly black,
too, and much smaller than most tadpoles in the
big pond. He could hardly wait for his front legs
to grow.
"When I have them all," he said, "I'll leave this
dirty water and go up into the orchard. What
fun it will be to hop and hop and hop. If only I
had a little brother to hop with me, I should be
so happy."

PLATE VI. SILENT READING BY FOURTH-GRADE SUBJECT, M. L. — AFTER TRAINING


It wasn't long before his legs began to grow.
He jumped about and kicked around until his
legs grew quite strong. "I am going out on the
bank to see if I can hop" he said one night when
he was just six weeks old.
The sun was hardly up the next morning when a
little toad jumped out of the water and hopped
out on the bank. He was very small, but none
too small for his little legs that wobbled under
him. It was tiny, the young toad.

Only the fixation-positions are marked. The subject was not in the exact focus, so the duration of the pauses could not be determined.

Table XXXI presents the figures for a detailed comparison of the two records of N. C.

3. *Record of a Fourth-Grade Subject of Medium Ability in Silent Reading*

Plate V shows the record of M. L. before training. M. L. is a nine-year-old girl in the fourth grade in the Hendricks School. Her reading ability is "fairly good." She stands apparently midway between the two previous fourth-grade subjects. Her rate in the Courtis Test is 136 words per minute; her comprehension is good. Her parents are native-born. She manifested very great interest in the training — Type I.

The record in Plate V shows a type of fourth-grade reader that might be classed as "fair." It is not nearly so poor as the initial record of A. P. (Plate I), nor nearly so good as the initial record of N. C. (Plate III). There is an average of 9.5 fixations per line, with an average duration of 11.3 fiftieths of a second per fixation-pause. Considering the number of fixations per line, the number of regressive movements are not numerous, averaging but 1 per line. Compare this record (Plate V) with either of N. C. 's records, and the excessively large number of fixation-pauses in M. L.'s reading becomes plainly evident. Improvement in reading rate would obviously seem to lie in the direction of a reduction of the number of fixations per line. There is room for improvement also in the irregular, unrhythmical character of the eye-movement habits.

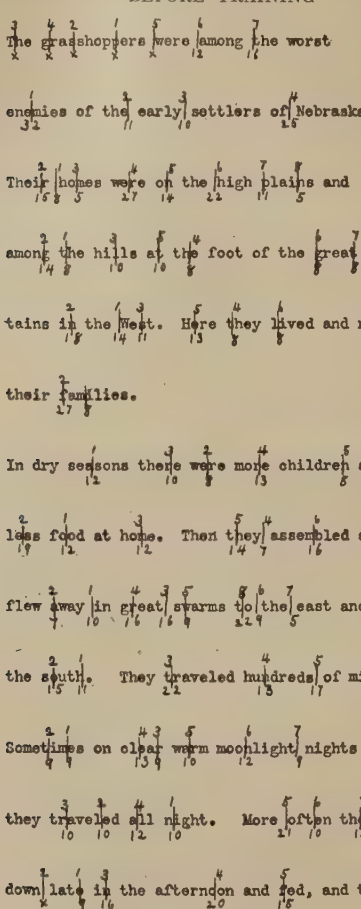
The record in Plate VI shows that this is precisely what happened in the previous record. The reduction in the number of fixation-pauses is rather striking. From a total of 76 fixations for the 8 full lines on record V the number for the 8 full lines on record VI is reduced to 58. This means an average reduction of 2.3 fixation-pauses per line. With the exception of line 1 on record VI, in which the subject evidently suffered from a poor start, the maximum number of fixations for any line is 8, which is the minimum number of fixations for any line in the subject's previous record.

Table XXXII presents the data contained in Plates V and VI in tabular form.

TABLE XXXII. COMPARISON OF THE EYE-MOVEMENT RECORDS OF A FOURTH-GRADE SUBJECT, M. L. — BEFORE AND AFTER TRAINING IN RAPID READING

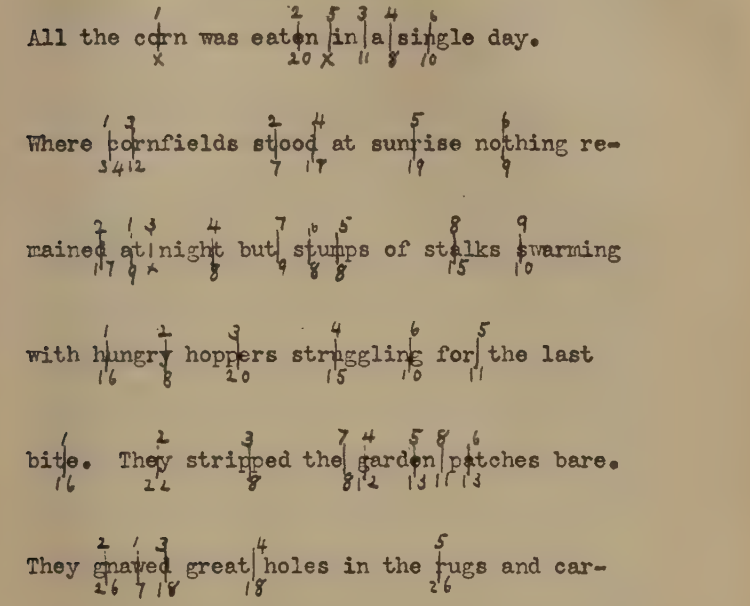
LINE	NUMBER OF PAUSES		DURATION OF PAUSES		NUMBER OF REGRESSIVE MOVEMENTS	
	Record		Record I		Record	
	I	II	Average	Aggregate	I	II
1	10	11	8.5	85	2	2
2	9	7	8.7	78	1	0
3	10	8	12.1	121	0	1
4	9	7	10.3	93	1	0
5	8	6	15.5	124	0	0
6	10	5	10.9	109	2	0
7	10	7	13.8	138	1	0
8	10	7	11.1	111	1	0
Total	76	58	90.9	859	8	3
Average	9.5	7.2	11.3	11.3	1.0	0.4

PLATE VII. SILENT READING BY FIFTH-GRADE SUBJECT, G. B. — BEFORE TRAINING


The grasshoppers were among the worst
enemies of the early settlers of Nebraska.
Their homes were on the high plains and
among the hills at the foot of the great moun-
tains in the West. Here they lived and raised
their families.
In dry seasons there were more children and
less food at home. Then they assembled and
flew away in great swarms to the east and to
the south. They traveled hundreds of miles.
Sometimes on clear warm moonlight nights
they traveled all night. More often they settled
down late in the afternoon and fed, and then
continued their way the next day.

X indicates that it was impossible to determine with accuracy the duration of the fixation-pause.

PLATE VIII. SILENT READING BY FIFTH-GRADE SUBJECT, G. B.—AFTER TRAINING


All the corn was eaten in a single day.
Where cornfields stood at sunrise nothing re-
mained at night but stumps of stalks swarming
with hungry hoppers struggling for the last
bite. They stripped the garden patches bare.
They gnawed great holes in the rugs and car-
pets put out to save favorite plants. The buds
and fruit of trees were consumed. They fol-
lowed the potatoes and onions into the ground.

X indicates that it was impossible to determine with accuracy the duration of the fixation-pause.

The reduction in the number of regressive movements is not less noticeable than the reduction in the number of fixation-pauses. From a total of 8, the number of regressive movements drops to 3. Record VI shows likewise the development of a habit of greater uniformity and rhythm in the character of the eye-movements. The results of the Courtis Test, in which the subject reached a rate of 284 words per minute, with very good comprehension, harmonize with the story told by the photographic record — a "higher order of eye-movement habits" was built up by the training to replace the lower order habits of eye-movements with which the subject began.

TABLE XXXIII. COMPARISON OF THE EYE-MOVEMENT RECORDS OF A FIFTH-GRADE SUBJECT, G. B. — BEFORE AND AFTER TRAINING

LINE	NUMBER OF PAUSES		AVERAGE DURATION OF PAUSE		AGGREGATE DURATION OF PAUSE		NUMBER OF REGRESSIVE MOVEMENTS	
	Record		Record		Record		Record	
	I	II	I	II	I	II	I	II
1	7	6		12.1		73	2	1
2	4	6	19.5	16.3	78	98	0	1
3	8	9	13.4	10.7	107	96	1	3
4	8	6	9.4	13.3	75	80	2	1
5	7	8	11.9	12.9	83	103	2	1
6	5	5	10.2	19.0	51	95	1	1
7	6	3	13.3	14.3	80	43	2	0
8	8	5	11.8	14.2	94	71	3	1
9	5	6	15.6	19.2	78	115	1	1
10	7		10.1		71		2	
11	7		12.1		85		2	
12	5		12.0		60		1	
Total	77	54	138.3	132	862	774	19	10
Average	6.4	6.0	12.3	14.3	12.3	14.3	1.6	1.1

II. Eye-Movement Records of Fifth-Grade Subjects — Before and After Training

1. *Record of Fifth-Grade Subject of Medium Ability in Silent Reading*

Plate VII shows the record of G. B. before training. G. B. is a ten-year-old girl in the fifth grade in the Manierre School. Her general class average was reported as 92 per cent by the teacher. Her reading ability was classified as "medium." She is of foreign-born parentage, but some English is spoken in the home. She is described as doing but little reading outside of school. Her rate in the Courtis Reading Test was 150 words per minute; her comprehension was good.

The record in Plate VII reflects a medium grade of reading ability. The record shows a fair degree of uniformity in the eye-movement habits. The average number of the fixations per line for the whole record is 6.4, which is considerably better than the average of 9.3 reported by C. T. Gray (19) for his fourth-grade subjects. The regressive movements are too frequent, however, averaging 1.6 per line. The average duration of the fixation-pauses is 12.3, which is less than the average of 14.3 reported by Gray for his fifth-grade subjects.

The record in Plate VIII shows somewhat of a reduction in the average number of the fixation-pauses per line — 6.4 to 6.0. The average duration of the pause has increased, however, from 12.3 fiftieths of a second

to 14.3 fiftieths. The average number of regressive movements per line is reduced from 1.6 to 1.1. On the whole, Plate VIII shows scarcely any appreciable improvement in the reading habits of the subject G. B. It is quite possible that the subject did not do her best when reading before the camera. As was pointed out before, the situation was quite an unusual one and may have exercised somewhat of a disturbing influence on this girl subject.

After the training in Type I the subject scored a rate of 278 words per minute on the Courtis Reading Test, with a comprehension mark of 94 per cent. This shows a considerable gain over her first score of 150 words per minute on the Courtis Test — a gain that is scarcely reflected at all in her photographic records. Lines 6, 7, and 8 towards the end of the record give evidence, however, that the subject is capable of rapid reading. The record for line 7 is much superior to the record of any line in the subject's previous performance.

2. *Record of a Very Rapid Fifth-Grade Reader*

Plate IX shows the record of L. C. before training. L. C. is a nine-year-old boy in the fifth grade in the Manierre School. The teacher reports that his general class average is 98 per cent; his reading ability is "excellent." He is described by the teacher as a very rapid reader who is able to retain what he reads. He is "fond of reading and reads extensively outside of school." His lips do not move in silent reading; he

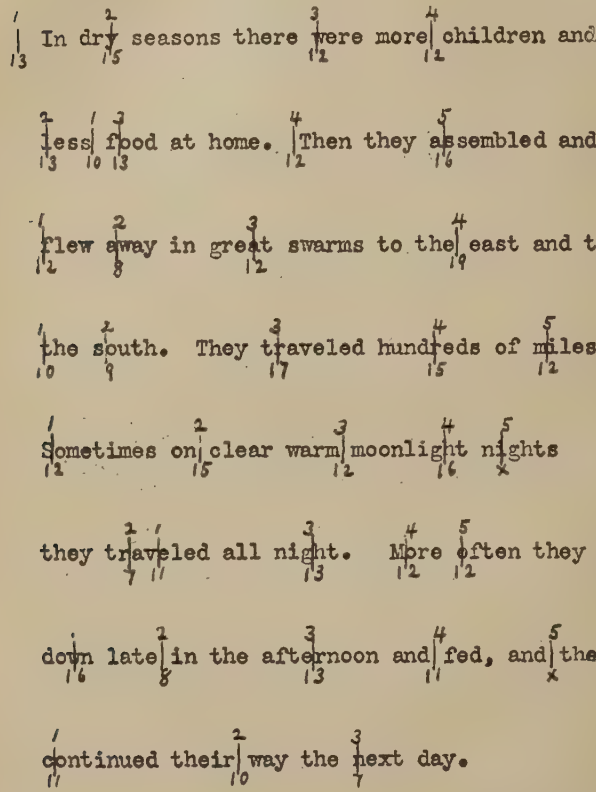
gives all the evidence of splendid concentration. His parents are native-born. The school records and the teacher's report indicate that L. C. is a "gifted" pupil. His progress through the grades has been accelerated.

The record on Plate IX shows that L. C. is an exceptionally able reader. The average number of fixation-pauses per line is but 5, which is practically but one-half of the average of 9.3 reported by Gray for his fifth-grade subjects. There are but 2 regressive movements in the whole record. The regularity and rhythm of eye-movement habits displayed by this record easily excel those of any of the previous records. The average duration of the fixation-pause is 12.8 as compared with the average of 14.3 reported by Gray. The record shows very clearly how L. C. was able to score 270 words per minute on the Courtis Reading Test and secure a mark of 100 per cent in comprehension by answering 47 questions correctly in the 5 minutes allowed.

The record in Plate IX might be thought to represent almost the physiological limit of reading prowess for a nine-year-old fifth-grade subject. Plate X shows, however, that L. C. improved very noticeably as a result of the training. There has been a reduction in the total number of fixation-pauses for the first 6 full lines in each record from 30 to 21; the average number per line has been lowered from 5.0 to 3.5. The average duration of the pauses has mounted but slightly —

from 12.4 to 12.8. There occurs but one regressive movement in the second record.

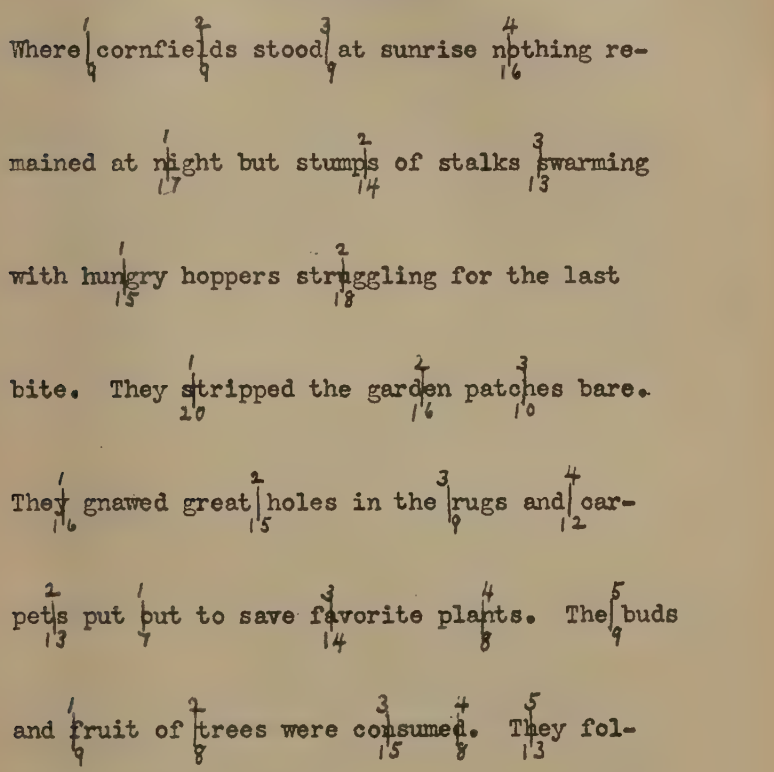
PLATE IX. SILENT READING BY FIFTH-GRADE SUBJECT, L. C.— BEFORE TRAINING


In dry seasons there were more children and
less food at home. Then they assembled and
flew away in great swarms to the east and to
the south. They traveled hundreds of miles.
Sometimes on clear warm moonlight nights
they traveled all night. More often they settled
down late in the afternoon and fed, and then
continued their way the next day.

There is a balance, a swing, a rhythm to the eye-movements of this subject which no previous record

has evidenced. The grasping of line 3 in two fixations is rather striking. It shows the wide visual span

PLATE X. SILENT READING BY FIFTH-GRADE SUBJECT, L. C.—AFTER TRAINING


Where cornfields stood at sunrise nothing re-
mained at night but stumps of stalks swarming
with hungry hoppers struggling for the last
bite. They stripped the garden patches bare.
They gnawed great holes in the rugs and car-
pets put out to save favorite plants. The buds
and fruit of trees were consumed. They fol-

which the subject utilizes in his reading. The average of 3.5 fixation-pauses per line is lower than any of the averages reported by Gray. In the hierarchy of eye-

movement habits which these photographic records have evidenced, Plate X stands as the reflex of the highest and most efficient type. There is a coördination, a harmonization of the constituent neurological processes of the reading complex, evidenced in Plate X, which stamps the reader as one of exceptional ability.

TABLE XXXIV. COMPARISON OF THE EYE-MOVEMENT RECORDS OF A FIFTH-GRADE SUBJECT, L. C. — BEFORE AND AFTER TRAINING IN RAPID READING

LINE	NUMBER OF PAUSES		AVERAGE DURATION OF PAUSE		AGGREGATE DURATION OF PAUSE		NUMBER OF PROGRESSIVE MOVEMENTS	
	Record		Record		Record		Record	
	I	II	I	II	I	II	I	II
1	5	4	12.8	10.8	64	43	1	0
2	4	3	12.7	14.7	51	44	0	0
3	5	2	12.6	16.5	63	33	0	0
4	5	3	13.8	15.3	69	46	0	0
5	6	4	10.8	13.0	65	52	1	0
6	5	5	12.0	10.2	60	51	0	1
Total	30	21	74.7	80.5	372	269	2	1
Average	5	3.5	12.4	12.8	12.4	12.8	0.3	0.2

This conclusion is further corroborated by L. C.'s record in the Courtis Test given at the end of the training. His rate was 395 words per minute, as against 270 on his first record. His index of comprehension was 97 per cent. He answered 66 questions out of a possible 70. Only 2 of his answers were incorrect. His record of 64 correct answers shows considerable

improvement over his previous record of 47. The increase in speed of L. C.'s reading as shown by the eye-movement records is from 48 lines per minute to 66 — an increase of 18 lines, or 38 per cent. This harmonizes fairly closely with the increase as shown by the Courtis Test of 125 words per minute, or 46 per cent. All in all, Plate X gives a record of the highest type of eye-movement habits photographed in this investigation. To facilitate a closer comparison of the two records of L. C., the data on each performance are presented in tabular form (Table XXXIV).

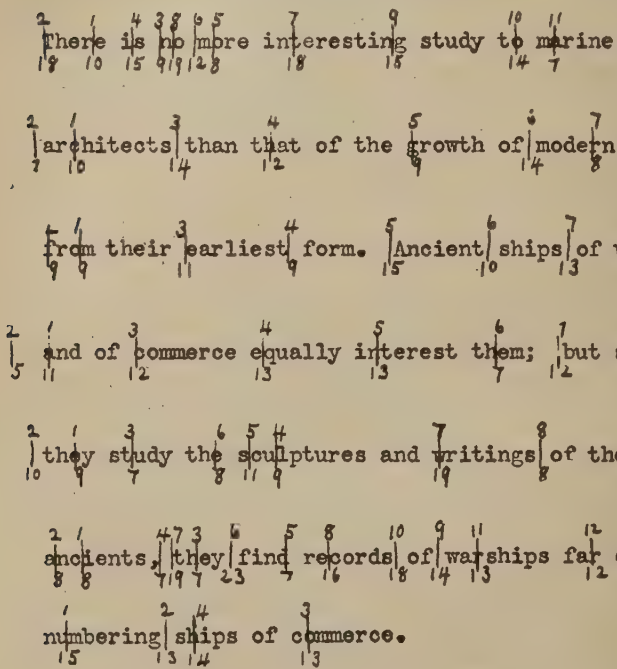
III. Eye-Movement Record of a Slow Seventh-Grade Reader

Plate XI shows the record of M. C. before training. M. C. is a twelve-year-old girl in the seventh grade in the Hendricks School. At the beginning of the training she was a slow, plodding reader. Her comprehension was good. Her rate on the Courtis Test was 170 words per minute. Her index of comprehension was 100 per cent, though she succeeded in answering only 28 questions as contrasted with the 47 correctly answered by the fifth-grade subject, L. C., before training. Her parents are native-born. The subject manifested great interest in the training.

The record in Plate XI would seem to indicate that the subject was of the over-careful type — painstakingly fixating practically every word — some of them twice. For a seventh-grade pupil such simple words

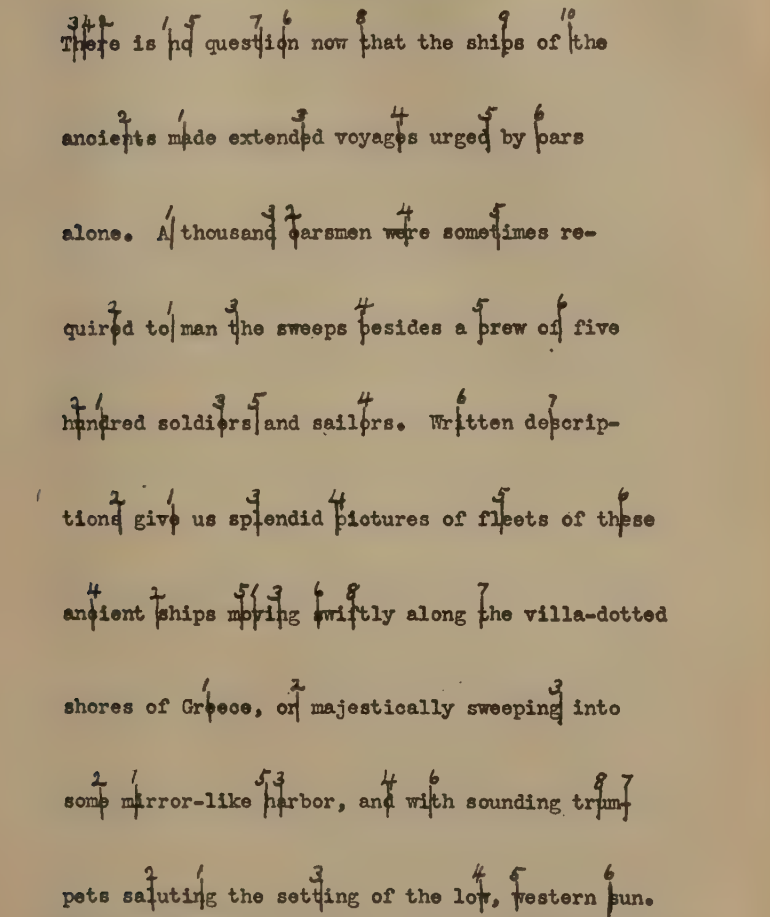
as are contained in lines 1 and 6 should not require 11 and 12 fixations respectively. The average number of fixation-pauses per line for the complete record is 8.4 as compared with an average of 7.7 reported by Gray

PLATE XI. SILENT READING OF SEVENTH-GRADE SUBJECT, M. C. — BEFORE TRAINING


There is no more interesting study to marine
architects than that of the growth of modern ships
from their earliest form. Ancient ships of war
and of commerce equally interest them; but as
they study the sculptures and writings of the
ancients, they find records of warships far out-
numbering ships of commerce.

for his 7 seventh-grade subjects. The total number of regressive movements for the 12 complete lines is 30; the average number per line is 2.5. The number is excessive. It indicates an over-cautiousness, a metic-

PLATE XII. SILENT READING BY SEVENTH-GRADE SUBJECT, M. C. — AFTER TRAINING


There is no question now that the ships of the
ancients made extended voyages urged by oars
alone. A thousand oarsmen were sometimes re-
quired to man the sweeps besides a crew of five
hundred soldiers and sailors. Written descrip-
tions give us splendid pictures of fleets of these
ancient ships moving swiftly along the villa-dotted
shores of Greece, or majestically sweeping into
some mirror-like harbor, and with sounding trum-
pets saluting the setting of the low, western sun.

Only the fixation-positions are marked. It was impossible to determine the duration of the fixation-pauses on this film.

ulousness, a dawdling over the words which would appear to be quite unnecessary for a subject whose comprehension is as good as M. C.'s. It is not unlikely the result of a slow, plodding, leisurely reading habit, which as Huey says, was probably "set and hardened in the days of listless poring over uninteresting tasks, or in imitation of the slow reading aloud, which was so usually going on." An average of 2.5 regressive movements to a line shows very clearly that the subject has not formed efficient habits of regular, systematic, rhythmical eye-movements, but suffers from inefficient, wasteful, time-consuming, repetitive ocular motor reactions, which have become habitual.

The record in Plate XII shows a considerable improvement. The average number of fixations per line has been reduced from 8.4 to 6.5. With the exception of line 1, no line required more than 8 fixations. The functioning of a wider perceptual span is clearly evident. Line 8 is grasped in 3 fixations, while the smallest number on any complete line in the subject's previous record was 6. The regressive movements dropped from an average of 2.5 to 1.6 per line, most of which occurred in the initial fixation in each line.

The subject is evidently finding some of her numerous fixation-pauses unnecessary and is setting up more efficient habits of regular rhythmical eye-movements. The improvement effected in the reading habits of this subject by training in Type I, which is reflected in the photographic records, is further shown by the data

from the Courtis Test administered at the end of the experiment. The subject scored a rate of 368 words per minute as contrasted with her previous score of 170. Her index of comprehension is 96 per cent, but she answered 67 questions, of which 65 were correct as compared with her previous record of 28 correct answers.

The data from the two eye-movement records of subject M. C. are presented in Table XXXV.

TABLE XXXV. COMPARISON OF THE EYE-MOVEMENT RECORDS OF A SEVENTH-GRADE SUBJECT, M. C. — BEFORE AND AFTER TRAINING

LINE	NUMBER OF PAUSES		DURATION OF PAUSES		NUMBER OF REGRESSIVE MOVEMENTS	
	Record		Record I		Record	
	I	II	Average	Aggregate	I	II
1	11	10	13.2	145	4	3
2	7	6	10.6	74	1	1
3	7	5	10.9	76	1	1
4	7	6	10.4	73	1	1
5	8	7	10.1	81	3	2
6	12	6	12.0	144	5	1
7	6	8	11.7	70	0	3
8	9	3	8.1	73	3	0
9	7	8	8.0	56	2	3
10	6	6	10.8	65	1	1
11	9		9.2	83	4	
12	12		8.8		5	
Total	101	65	123.8	1037	30	16
Average	8.4	6.5	10.3	10.3	2.5	1.6

A few other photographic records were taken of elementary pupils, but it is thought that the records shown

above reflect sufficiently well the important modifications in the eye-movement habits, *i.e.* in the number and duration of fixation-pauses, number of regressive movements, and regularity of the eye-movements, which were effected by the experimental training.

Eye-Movement Records of an Adult in Oral and Silent Reading

Plate XIII shows the record of an adult, J. A., in silent reading. The subject is a graduate student at the University of Illinois who has read rather extensively. He had received some training in Type I. It was thought that a comparison of the eye-movement record of a trained adult reader with the records of elementary school pupils would yield some interesting results. The record seems to reflect a greater degree of maturity than any of the previous records, with the single exception of the record of L. C. after training, as shown in Plate X. With the exception of the latter record, the average number of fixation-pauses per line, 4.3 in J. A.'s reading, is less than the average achieved by any of the grade pupils. The average duration of the fixation-pauses in J. A.'s record is 11.3, which is 1.5 less than the average duration of the fixations in L. C.'s record. There is a greater regularity and more of a rhythmical character to the ocular motor reaction in J. A.'s record than appears in most of the previous records. The average number of regressive movements per line is very small — but 0.4. The perceptual span

is wider than that reflected in most of the records of the elementary pupils.

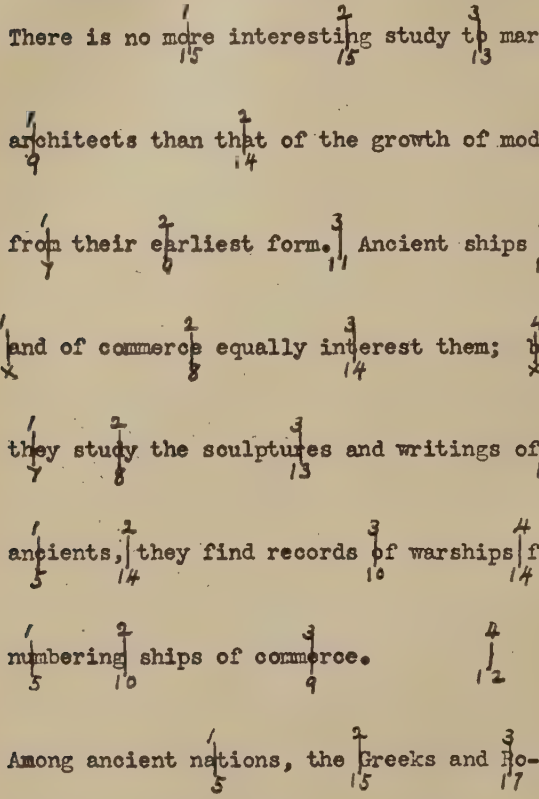
TABLE XXXVI. COMPARISON OF EYE-MOVEMENT RECORDS OF SILENT AND ORAL READING BY ADULT SUBJECT, J. A.

LINE	NUMBER OF PAUSES		AVERAGE DURATION OF PAUSE		AGGREGATE DURATION OF PAUSES		NUMBER OF REGRESSIVE MOVEMENTS	
	Oral	Silent	Oral	Silent	Oral	Silent	Oral	Silent
1	6	3	13.5	14.3	81	43	1	0
2	8	4	13.2	10.7	106	43	2	1
3	6	5	14.8	9.8	89	49	1	1
4	5	4	15.2	11.0	76		0	0
5	7	4	12.6	10.0	88	40	1	0
6	6	4	11.7	10.6	70	43	0	0
7	7	3	16.9	12.3	128	37	1	0
8	5	6	21.0	10.7	105	64	0	1
9	5	5	13.2	10.8	76	54	0	1
10	5	4	16.4	14.0	82	56	1	0
11	7	3	14.8	15.3	94	46	1	0
12	7	4	12.4	11.5	87	46	1	0
13	5	7	14.4	10.0	72	70	0	1
Total . . .	79	56	190.1	151.0	1154	591	9	5
Average . .	6.1	4.3	14.6	11.3	14.6	11.3	0.7	0.4

After the subject J. A. had read the selection silently before the camera, he was requested to read it orally to see how the two records would compare. Though the subject had the advantage of being more familiar with the passage when he was called to read orally, yet the record in Plate XIV shows that oral reading occasions much more cumbrous and awkward ocular motor adjustments than its silent prototype. The average number of fixation-pauses per line immediately

rises from 4.3 to 6.1, showing that the perceptual process is forced to wait upon the slower process of vocalization.

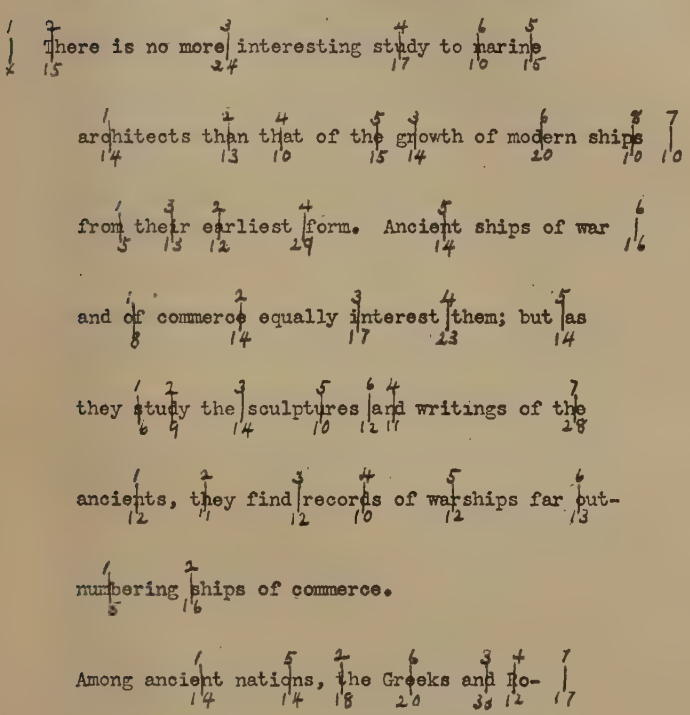
PLATE XIII. SILENT READING BY ADULT SUBJECT, J. A.


There is no more interesting study to marine
architects than that of the growth of modern ships
from their earliest form. Ancient ships of war
and of commerce equally interest them; but as
they study the sculptures and writings of the
ancients, they find records of warships far out-
numbering ships of commerce.
Among ancient nations, the Greeks and Ro-

It is significant also that the average duration of the pauses mounts from 11.3 to 14.6. The total number of

regressive movements jumps from 5 to 9. The uniformity of the ocular motor reaction habits is disturbed by the attempt to synchronize the perceptual process

PLATE XIV. ORAL READING BY ADULT SUBJECT, J. A.


There is no more interesting study to marine
architects than that of the growth of modern ships
from their earliest form. Ancient ships of war
and of commerce equally interest them; but as
they study the sculptures and writings of the
ancients, they find records of warships far out-
numbering ships of commerce.
Among ancient nations, the Greeks and Ro-

with the slower and more unwieldy process of articulation with the latter's more complete dependence upon an elaborate physiological mechanism. In short,

the record of silent reading shows a marked and unmistakable superiority over the oral reading in practically every important phase of the eye-movements, *i.e.* the number of fixations, the length of fixations, the number of regressive movemen s, and regularity of eye-movement habits. It shows clearly the physiological basis for the unmistakable superiority of silent over oral reading, both in point of time and energy expended.

The data from the complete records of J. A.'s silent and oral reading are thrown into tabular form to facilitate comparison of the two records. (Table XXXVI.)

TABLE XXXVII. COMPARISON OF THE NUMBER OF FIXATION-PAUSES AND REGRESSIVE MOVEMENTS OF FIVE ELEMENTARY SCHOOL PUPILS — BEFORE AND AFTER TRAINING IN RAPID READING

PUPILS	AVERAGE NUMBER OF PAUSES		AVERAGE NUMBER OF REGRESSIVE MOVEMENTS	
	Record		Record	
	I	II	I	II
L. C.	5.0	3.5	0.3	0.2
M. C.	8.4	6.5	2.5	1.6
A. P.	11.7	7.8	2.4	1.0
N. C.	7.1	5.1	1.1	1.1
M. L.	9.5	7.2	1.0	0.4
Total	41.7	30.1	7.3	4.3
Average	8.3	6.0	1.5	0.8

Table XXXVII epitomizes the effect of the experimental training upon the number of the fixation-pauses

and the number of regressive movements in the reading of five elementary school pupils. The records of their eye-movements have been presented in this chapter. The subject G. B. is omitted from the table because the improvement, if any, in this case is less clearly discernible than in the others. In an endeavor to determine whether the increase in speed of reading is due to the lessening of the number of pauses, or to the shortening of the duration of the pauses, his record, showing no increase in speed, obviously could not be used. The table shows that the acquisition of a habit of rapid reading such as these subjects achieved, results in a *noticeable reduction in the number of fixation-pauses.* The average number of fixations per line for the five subjects before training is 8.3; after training in rapid reading, it is reduced to 6.0 — *a decrease of 2.3 per line.* The reduction in the number of regressive movements is also quite marked. From an average of 1.5 per line for the first reading it drops to the small average of 0.8.

An effort was also made to compare the rate of the interfixation and the interlinear movements of the eyes in the first and second reading records of three of the subjects. The rate was measured in σ ($\frac{1}{1000}$ of a second). The apparatus was scarcely delicate enough, however, to measure σ with perfect accuracy. The average time per line consumed by the interfixation movements in the first reading record was 122σ as compared with 101σ in the record taken after training. The average for the interlinear movements in the first

record was 42σ as compared with 57σ for the second record. The results do not point to any significant change in the rate of the interfixation or interlinear movements.

Unfortunately the duration of the fixation-pauses for both the first and second records could be determined for but three of the six subjects whose records are shown. In two of these, the duration of the pauses is slightly longer in the second record; in the other one it remains approximately the same. It is very probable that a marked reduction in the number of fixations results in an increase, more or less, in the average duration of the fixation. While the average duration of the fixation becomes slightly larger, the aggregate duration of the pauses per line is much less than before the reduction in the number of fixations. The records of L. C. in Table XXXIV and of A. P. in Table XXX are good illustrations of this. Though the average duration per pause for L. C.'s second record is 12.8 as compared with 12.4 for his first record, yet the aggregate duration of the pauses per line in the second record is less for every line than in the first record. The reduction in the number of fixations means that the fixations must embrace a wider area. The grasping of more material in a single fixation would naturally seem to be accompanied by a slight increase in the duration of the pause.

Considering the limited number of subjects whose eye-movements were photographed in this investiga-

tion, the conclusions which an analysis of these records would clearly seem to justify are:

1. A habit of speed in silent reading acquired through persistent training is accompanied physiologically chiefly by a reduction in the number of fixation-pauses.

2. The types of training utilized in this investigation effected a noticeable reduction in the number of regressive movements as shown by the eye-movements which were photographed.

CHAPTER XI

SUMMARY OF CONCLUSIONS

It was not the purpose of this experiment to isolate and weigh separately the effect of different single factors upon the rate in silent reading. That is one of the interesting and fascinating problems in the experimental psychology of reading which yet awaits the hand of the investigator. The purpose of this investigation was to determine the effectiveness of a group of factors synthesized into an organized method or type of training upon the rate in silent reading. The query of practical pedagogical consequence back of the investigation was: How can speed in silent reading be developed without impairing the comprehension of the matter read?

Practically all the conclusions issuing from the present investigation are contained in the two previous chapters. For the sake of convenience, some of the more important generalizations are expressed here.

This investigation has shown that rate in silent reading may be accelerated to a marked degree by training in rapid silent reading. This was demonstrated for all the grades investigated, namely, grades three

to eight. In the course of two months' training in rapid reading, an average gain for the experimental pupils in the five grades of 110 words per minute was effected, as compared with an average gain of 64 words per minute for the control pupils. Reducing the average gain in number of words read per minute to a percentage basis, the amount of improvement for the experimental pupils in all the grades was 56 per cent, as against 25 per cent for the controls — an average superiority of 31 per cent for the experimental pupils.

Inasmuch as the control pupils were taught by the same teacher in the same classroom with the experimental, they were not entirely unaffected by the experimental training. Their increase in speed was consequently greater than that of pupils receiving only the conventional training in reading in classrooms where no experimental training was in evidence. This is shown by a comparison of their final averages in rate with the present norms. Consequently, the superiority of the average gain in rate of the experimental pupils over the control pupils — great as it is — does not fully reflect the degree of superiority of the rates of the experimental pupils over the present norms for the different grades. This is shown by a direct comparison of the final averages of the experimental pupils with the norms reported by Courtis, Starch, Gray, and others, for the different grades. This comparison shows also that the present reading rates of pupils in the different grades are unnecessarily slow and inefficient. A com-

paratively brief period of training can increase them more than 50 per cent.

Concomitant with the marked increase in speed there resulted a slight improvement in the accuracy of the comprehension. The average gain of the experimentals was 0.9 per cent as against a loss of 0.7 per cent for the controls — a final average superiority in gain over the controls of 1.6 per cent in comprehension. This is the improvement as measured by the Courtis Index, which is chiefly an index of accuracy. As measured by the number of questions correctly answered, the improvement in comprehension is notably greater — an average increase of 12.5 questions correctly answered, or 29 per cent. In fact the number of *questions correctly answered* by the experimental pupils in each grade after training is greater than the norms for the total number of questions *attempted*, whether *answered correctly or wrongly*, as reported by Courtis.

This increase indicates furthermore a persistence of the improvement effected in rate in different situations an different mental attitudes, as in reading simply to "get the gist," and in reading to answer questions.

The eye-movement records show that the improvement is effected physiologically chiefly by a lessening of the number of fixations rather than by a shortening of the average duration of the fixations. The improvement is also accompanied by a decrease in the number of regressive movements and by the "setting up" of habits of regular rhythmical eye-movements.

The pedagogical implication of this finding is that short exposure exercises, in which the amount of material exposed is gradually increased, rather than the amount of exposure time being decreased, tend to develop speed in reading. It demonstrates that the directions in the types of training, outlined in this study, to "see more at a glance," etc., are well based. It shows that the development of speed in silent reading is, in reality, reducible to the *more effective utilization of the perceptual span in reading.*

BIBLIOGRAPHY

1. Holmes, Henry W. "Time Distribution by Subjects and Grades in Representative Cities," *Fourteenth Yearbook of the National Society for the Study of Education*, part 1, pp. 21–27. Chicago: University of Chicago Press, 1915.
2. Charters, Werrett W. *Methods of Teaching.* Chicago: Row, Peterson & Co., 1909. 225 pp. (Chapter 13.)
3. Cattell, James M. "Reactions and Perceptions," *Essays Philosophical and Psychological in Honor of William James.* New York: Longmans, Green & Co., 1908. 610 pp. (pp. 569–84.)

   Cattell, James M. "On the Relations of Time and Space in Vision," *Psychological Review*, 7: 325–43, July, 1900.

   Cattell, James M. "The Inertia of the Eye and Brain," *Brain*, 8: 295–312, October, 1885.

   Cattell, James M. "Ueber die Zeit der Erkennung und Benennung von Schriftzeichen, Bildern und Farben," *Philosophische Studien*, 2: 635–50, 1885.
4. Goldscheider, A. and Muller, R. F. "Zur Physiologie und Pathologie des Lesens," *Zeitschrift für klinische Medicin*, 23: 131, 1893.
5. Erdmann, B. and Dodge, R. *Psychologische Untersuchungen über das Les n auf experimenteller Grundlage.* Halle: M. Niemeyer, 1898. 360 pp.

   Erdmann, B. and Dodge, R. "Zur Erlauterung unserer tachistoskopischen Versuche," *Zeitschrift für Psychologie*, 22: 241–67, 1900.
6. Huey, Edmund B. *The Psychology and Pedagogy of Reading.* New York: The Macmillan Company, 1913. 469 pp.
7. Schmidt, William A. "An Experimental Study in the Psychology of Reading." (Supplementary Educational Monograph, v. 1, no. 2, April, 1917.) Chicago: University of Chicago Press, 1917. 126 pp.
8. Javal, Emile. "Sur la physiologie de la lecture," *Annales d'Oculistique*, 1878–1879.

9. Lamare. "Des Mouvements des yeux pendant la lecture," *Comptes rendus de la Société française d'Ophtalmologie*, pp. 354 ff., 1893.
10. Ahrens, August. *Die Bewegung der Augen beim Schreiben*, Rostock, 1891.
11. Delabarre, E. B. "A Method of Recording Eye Movements," *American Journal of Psychology*, 9 : 572–74, July, 1898.
12. Huey, E. B. "Preliminary Experiments in the Physiology and Psychology of Reading," *American Journal of Psychology*, 9 : 575–86, July, 1898.
    Huey, E. B. "On the Psychology and Physiology of Reading," *American Journal of Psychology*, 11 : 293–302, 12 : 292–312, 1900–1901.
13. Dodge, Raymond. "An Experimental Study of Visual Fixation," *Psychological Review, Monograph Supplement*, v. 8.
    Cf. also Dodge, R. and Cline, T. S. "The Angle Velocity of Eye-Movements," *Psychological Review*, 8 : 145–57, March, 1901.
14. Dearborn, Walter F. "The Psychology of Reading," *Columbia University Contributions to Philosophy and Psychology*, v. 14, no. 1, 1906.
15. Judd, C. H., McAllister, C. N., and Steele, W. M. "Introduction to a Series of Studies of Eye Movements by Means of Kinetoscopic Photographs," *Psychological Review, Monograph Supplement*, v. 7, no. 1, pp. 1–16, March, 1905.
    Judd, C. H. "Photographic Records of Convergence and Divergence," *Psychological Review, Monograph Supplement*, v. 8, no. 3, pp. 370–423, June, 1907.
16. Holt, E. B. "Eye Movement and Central Anæsthesia," *Psychological Review, Monograph Supplement*, v. 4, January, 1903.
17. Dearborn, Walter F. "The Psychology of Reading," *Columbia University Contributions to Philosophy and Psychology*, v. 14, no. 1, 1906.
18. Schmidt, William A. *An Experimental Study in the Psychology of Reading*. Chicago : University of Chicago Press, 1917. 126 pp. (p. 79.)
19. Gray, Clarence T. *Types of Reading Ability as Exhibited through Tests and Laboratory Experiments*. (Supplementary Educational Monograph, v. 1, no. 5, August, 1917.) Chicago : University of Chicago Press, 1917. 196 pp.
20. Gray, William S. "Principles of Method in Teaching Reading as derived from Scientific Investigation," *Eighteenth Yearbook of*

the National Society for the Study of Education, part 2, pp. 26–51 (pp. 40, 41). Bloomington, Illinois: Public School Publishing Co., 1919.

21. Judd, Charles H. *Reading: Its Nature and Development.* (Supplementary Educational Monograph, v. 2, no. 4, July, 1918.) Chicago: University of Chicago Press, 1918. 192 pp.
22. Pintner, Rudolf. "Oral and Silent Reading of Fourth Grade Pupils," *Journal of Educational Psychology*, 4: 333–37, June, 1913.
23. Oberholtzer, E. E. "Testing the Efficiency of Reading in the Grades," *Elementary School Journal*, 15: 313–22, February, 1915.
24. Mead, Cyrus D. "Silent versus Oral Reading with One Hundred Sixth Grade Children," *Journal of Educational Psychology*, 6: 346–48, June, 1915.
25. Pintner, Rudolf and Gilliland, A. R. "Oral and Silent Reading," *Journal of Educational Psychology*, 7: 201–12, April, 1916.
26. Quantz, J. O. "Problems in the Psychology of Reading," *Psychological Review, Monograph Supplement*, v. 2, no. 1, December, 1897.
27. Hendricks, Eldo L. *A Preliminary Report of a Study of Reading.* Boston: Silver, Burdett & Co., 1911. 32 pp.
28. Judd, Charles H. *Measuring the Work of the Public Schools.* Cleveland, O.: The Survey Committee of the Cleveland Foundation, 1916, 290 pp.
29. Mann, Horace. "Second Annual Report of the Secretary of the Board of Education, 1838," *Life and Works of Horace Mann*, 2: 531–32. Boston: Lee and Shepard, 1891. 5 v.
30. Judd, Charles H. *Reading: Its Nature and Development.* Chicago: University of Chicago Press, 1918. 192 pp. (p. 184.)
31. Thorndike, Edward L. "Reading as Reasoning: A Study of Mistakes in Paragraph Reading," *Journal of Educational Psychology*, 8: 323–32, June, 1917. (p. 332.)
32. Judd, Charles H. *Reading: Its Nature and Development.* Chicago: University of Chicago Press, 1918. 192 pp. (pp. 150, 151, 155, 146.)
33. Bowden, Josephine. *Learning to Read.* (Master's thesis, University of Chicago, 1911.)
34. Abell, Adelaide M. "Rapid Reading: Advantages and Methods," *Educational Review*, 8: 283–86. October, 1894.
35. Dodge, Raymond. *Die Motorischen Wortvorstellungen.* Halle: N. Niemeyer, 1896. 78 pp. (p. 65.)

36. Whipple, Guy M. "The Effect of Practice upon the Range of Visual Attention and of Visual Apprehension," *Journal of Educational Psychology*, 1 : 249–62, March, 1910.
37. Peters, Charles C. "The Influence of Speed Drills upon the Rate and Effectiveness of Silent Reading," *Journal of Educational Psychology*, 8 : 350–66, June, 1917.
38. Gray, William S. *Studies of Elementary School Reading through Standardized Tests.* (Supplementary Educational Monograph, v. 1, no. 1.) Chicago : University of Chicago Press, 1917.
39. Fordyce, Charles. "Testing the Efficiency in Reading," *Addresses and Proceedings of the National Education Association*, 55 : 818–21, July 7–14, 1917. (p. 821.)
40. Whipple, G. M. and Curtis, Josephine N. "Preliminary Investigation of Skimming in Reading," *Journal of Educational Psychology*, 8 : 333–49, June, 1917.
41. Gray, William S. "Reading." *Survey of the St. Louis Public Schools*, v. 2. St. Louis : Board of Education, 1917.
42. Ruediger, William C. "Field of Distinct Vision," *Columbia Contributions to Philosophy and Psychology*, v. 16, no. 1, 1907.
43. Messmer, Oskar. "Zur Psychologie des Lesens bei Kinder und Erwachsenen," *Archiv für die Gesamte Psychologie*, Band II, Heft 2–3, pp. 190–298 Vorlesungen, B. 3S. December, 1903.
44. Ribot, Th. "Les Mouvements et leur importance psychologique," *Revue Philosophique*, 8 : 371–86, October, 1879.
45. Bain, Alexander. *The Senses and the Intellect.* 1868. p. 336.
46. Egger, Victor. *La Parole interieure.* Paris : G. Bailliere et Cie. 1881.
47. Ballet, Gilbert. *Le Langage interieur et les diverses formes de l'aphasie.* Paris : F. Alcan, 1886.
48. Pintner, Rudolf. "Inner Speech during Silent Reading," *Psychological Review*, 20 : 129–53, January, 1915.
49. Stricker, S. *Studien über die Sprachvorstellungen.* Vienna : Ebendas, 1880. 106 pp.
50. Stumpf, Carl. *Tonpsychologie.* Leipzig : Hirzel, 1883. 427 pp. (p. 154 ff.)
51. Paulhan, Fr. "Le Langage interieur et la pensée," *Revue Philosophique*, 21 : 26–58, January, 1886.
52. Baldwin, James. *Mental Development in the Child and the Race.* 1895. p. 442.
53. Bastian, Henry C. *Brain as an Organ of Mind.* 1891. p. 595 ff.

54. Collins, J. *The Genesis and Dissolution of the Faculty of Speech, a Clinical and Psychological Study of Aphasia.* New York: The Macmillan Company, 1898. 432 pp. (p. 195 ff.)
55. Dodge, Raymond. "Die motorischen Wortvorstellungen," *Psychological Review*, 4: 326–27, May, 1897.
56. Bawden, H. H. "A Study of Lapses," *Psychological Review, Monograph Supplement*, v. 3, no. 4, 1900. p. 154 ff.
57. Curtis, H. S. "Automatic Movement of the Larynx," *American Journal of Psychology*, 11: 237–39, January, 1900.
58. Courten, H. C. "Involuntary Movements of the Tongue," *Studies from the Yale Psychological Laboratory*, v. 10, pp. 93–95, 1902.
59. Hansen, F. C. C. and Lehmann, Alfred. "Ueber unwillkürliches Flüstern," *Wundt's Philosopische Studien*, 11: 471–530, 1895.
60. Secor, W. B. "Visual Reading: A Study in Mental Imagery," *American Journal of Psychology*, 11: 225–36, January, 1900.
61. Dodge, Raymond. "The Psychology of Reading," *Cyclopedia of Education*, 1917. v. 5, p. 117.
62. Pfeiffer, Ludwig. *Ueber Vorstellungstypen.* Leipzig: O. Nemnich, 1907. 129 pp.
Pfeiffer, Ludwig. *Experimentelle Untersuchungen über qualitative Arbeitstypen.* Leipzig: O. Nemnich, 1907. 281 pp.
63. Segal, J. "Ueber den Reproduktionstypus und das Reproduktion von Vorstellungen," *Archiv für die Gesamte Psychologie*, 12: 124–235, 1908.
64. Lobsien, Marx. *Ueber den Vorstellungstypus der Schulkinder.* 1911. 457 pp
65. Cohn, Jonas. "Experimentelle Untersuchungen über das zusammenwirken des akustisch-motorischen und des visuellen Gedachtnisses," *Zeitschrift für Psychologie*, 15: 161–83, 1897.
66. Baade, Walter. *Experimentelle und kritische Beitrage zur Frage nach der sekundaren Wirkungen des Unterrichts.* Leipzig: O. Nemnich, 1907. 124 pp.
67. Storring, Gustav. *Mental Pathology.* Translated by Thomas Loveday. London, 1907. 298 pp.
68. Netschajeff, A. "Die Entwickelung des Gedachtnisses bei Schulkindern," *Zeitschrift für Psychologie*, 24: 321–51, 1900.
Netschajeff, A. *Ueber Memorieren und Gedachtnis.* Berlin: Reuther and Reikard, 1903. 39 pp.
69. Meumann, Ernest. *The Psychology of Learning.* Translated from 3d ed. of "The Economy and Technique of Learning," by John

W. Baird. New York: D. Appleton & Co., 1913. 393 pp. (p. 193.)

70. Offner, Max. *Mental Fatigue*. Translated from the German by G. M. Whipple. Boston: Warwick and York, 1911. 133 pp.
71. Rivers, W. H. and Kraepelin, E. "Ueber Ermüdung und Erholung," *Psychologische Arbeiten*, 1: 627–78, 1896.
72. Courtis, S. A. "Standard Tests in English," *Elementary School Journal*, 14: 374–92, April, 1914.

APPENDIX[1]

List of Books for Silent Reading

The following list of books has been selected by Mr. James P. Hosic of the Chicago Normal School from a much larger list which he had prepared for use in certain Chicago schools designated for the time as "English Centers."

The present list is prepared especially for use in certain schools of the state where a method of improving silent reading has been tested out by Dr. John A. O'Brien under the direction of Dr. B. R. Buckingham of the University of Illinois. The last few titles under each grade are from the Supplementary Reading List adopted February 13, 1919, by the Chicago Board of Education.

Second Grade

Dutton	In Field and Pasture	American Book Co.
Schaffner	Sam; or, Our Cat Tales	Atkinson, Mentzer & Co.

Third Grade

Baldwin	Fifty Famous Stories	American Book Co.
Bigham	Merry Animal Tales	Little, Brown & Co.
Craik	Adventures of a Brownie	Educational Publishing Co.

[1] The shift of emphasis from oral to silent reading necessitates the use of a larger amount of reading material in all the grades from the second to the eighth. These lists are appended in the hope that they may assist teachers to solve the consequent problem of finding a sufficient amount of material suitable for either basic or supplementary reading. Many of the readers cited in these lists are published by several firms. Where no publisher is specified, the book as a rule can be procured from practically any publishing company.

Gale	Achilles and Hector	Public School Publishing Co.
McMurry	Story of Robinson Crusoe	Public School Publishing Co.
Mulock	Little Lame Prince	D. C. Heath & Co.
Sindelar	Father Thrift and His Animal Friends	Beckley-Cardy Co.
Sindelar	Nixy-Bunny in Far Away Lands	Beckley-Cardy Co.
Stevenson	Children's Classics in Dramatic Form, Book 2	Houghton Mifflin Co.
Scudder	Fables and Folk Stories	Houghton Mifflin Co.
Schmidt	A Dramatic Reader, Book 3	B. D. Berry
Holbrook	A Dramatic Reader for Lower Grades	American Book Co.
Burgess	Old Mother West Wind	Little, Brown & Co.
Segur	Story of a Donkey	D. C. Heath & Co.

FOURTH GRADE

Aanrud	Lisbeth Longrock	Ginn & Co.
Baker and Thorndike	Everyday Classics, Book 4	The Macmillan Company
Bigham	Fanciful Flower Tales	Little, Brown & Co.
Carrol	Alice in Wonderland	Rand-McNally & Co.
Collodli	Adventures of Pinocchio	Ginn & Co.
Ghosh	Wonders of the Jungle	D. C. Heath & Co.
Harris	Little Mr. Thimblefinger	Houghton Mifflin Co.
Large	A Visit to the Farm	The Macmillan Company
Mirick and Holmes	Home Life around the World	Houghton Mifflin Co.
Schwartz	Grasshopper Green's Garden	Little, Brown & Co.
Schwartz	Wilderness Babies	
Segur	Sophie	D. C. Heath & Co.
Wesselhoeft	Jack the Fire Dog	Little, Brown & Co.
Wiggin	Story of Patsy	Houghton Mifflin Co.
Warren	King Arthur and His Knights	Rand-McNally & Co.
Warren	Robin Hood and His Merry Men	Rand-McNally & Co.
Cook	Story of Ulysses	Public School Publishing Co.

Fifth Grade

Alcott	Little Women	Little, Brown & Co.
Austin	The Basket Woman	Houghton Mifflin Co.
Bachman	Great Inventors and Their Inventions	American Book Co.
Baker and Thorndike	Everyday Classics, Book 5	The Macmillan Company
Dodge	Hans Brinker	Ginn & Co.
Hyde	Favorite Greek Myths	D. C. Heath & Co.
Kipling	Just So Stories	Century Co.
Long	Wood Folk at School	Ginn & Co.
Seton	Krag and Johnny Bear	Charles Scribner's Sons
Gale	Achilles and Hector	Rand-McNally & Co.
Stevenson	Children's Classics in Dramatic Form, Book 4	Houghton Mifflin Co.
Baldwin	Golden Fleece	American Book Co.
Harris	Little Mr. Thimblefinger	Houghton Mifflin Co.
Spyri	Moni, The Goat Boy	Ginn & Co.
Skinner	Tales and Plays of Robin Hood	American Book Co.

Sixth Grade

Baldwin	American Book of Golden Deeds	American Book Co.
Carter	Stories of Brave Dogs	Century Co.
Faris	Makers of Our History	Ginn & Co.
Hill	Fighting a Fire	Century Co.
Lagerlof	Wonderful Adventures of Nils	Grosset & Dunlap
Lang	Story of Joan of Arc	
Moore	Story of Christopher Columbus	Houghton Mifflin Co.
Roosevelt	Stories of the Great West	Century Co.
Wiggin and Smith	The Posy Ring	Doubleday, Page & Co.
Spyri	Heidi	Ginn & Co.
Mabie	Norse Stories	Rand-McNally & Co.
Baldwin	Old Greek Stories	American Book Co.

Church	Story of the Iliad	The Macmillan Company
Church	Story of the Odyssey	The Macmillan Company
Baldwin	Thirty More Famous Stories Retold	American Book Co.

SEVENTH GRADE

Aldrich	Story of a Bad Boy	Houghton Mifflin Co.
Baker and Thorndike	Everyday Classics, Book 7	The Macmillan Company
Barrie	Peter and Wendy	
Brooks	The Story of King Arthur	Penn Publishing Co.
Fitz-Hugh	Boy's Book of Scouts	T. Y. Crowell Co.
Hale	Man without a Country	Little, Brown & Co.
Jordan	The Story of Matka	
Mace	Life of Lincoln	Rand-McNally & Co.
Pierce	Great Inventors and Discoverers	Charles E. Merrill Co.
Sanford and Owen	Modern Americans	Laurel Book Co.
Stoddard	Red Mustang	Harper Bros.
Seton	Trail of the Sandhill Stag	
Weed	Bird Life Stories	Rand-McNally & Co.
Williams	Some Successful Americans	Ginn & Co.
Stevenson	Children's Classics in Dramatic Form, Book 5	Houghton Mifflin Co.
Montgomery	Heroic Ballads	Ginn & Co.

EIGHTH GRADE

Baker and Thorndike	Everyday Classics, Book 8	The Macmillan Company
Baldwin	Fifty Famous Rides	
Chapin	Story of the Rhinegold	
Cooper	Last of the Mohicans	
D'Amicis	Heart of a Boy	Rand-McNally & Co.
Eastman	An Indian Boyhood	
Fabre	Insect Adventures	Dodd, Mead & Co.
Grenfel	Adrift on an Ice Pan	Houghton Mifflin Co.
Mace	Life of Washington	Rand-McNally & Co.

Madden	Emmy Lou	
Rice	Mrs. Wiggs of the Cabbage Patch	
Scott	Talisman	
Thompson	Scouting with Daniel Boone	Doubleday, Page & Co.
	Western Frontier Stories	Century Co.
Wiggin and Smith	Golden Numbers	Doubleday, Page & Co.
Tennyson and others	Poems of Knightly Adventure	Newson & Co.

Titles for Silent Reading Furnished by the Conference at the University of Illinois, April 12, 1919.

THIRD GRADE

Blaisdell	Bunny Rabbit's Diary	Little, Brown & Co.
Craik	Bow-wow and Mew-mew	Charles E. Merrill Co.
Lucia	Peter and Polly in Spring	American Book Co.
Lucia	Peter and Polly in Summer	American Book Co.
Lucia	Peter and Polly in Winter	American Book Co.
Varney	Robin Reader, first Reader	Charles Scribner's Sons

FOURTH GRADE

Bigham	Fanciful Flower Tales	Little, Brown & Co.
Bigham	Merry Animal Tales	Little, Brown & Co.
Bryce	That's Why Stories	Newson & Co.
Haliburton	Third Reader	D. C. Heath & Co.
Holbrook	Book of Nature Myths	Houghton Mifflin Co.
Burgess	Mother West Wind "How" Stories	Little, Brown & Co.
Burgess	Mother West Wind "Why" Stories	Little, Brown & Co.
Burgess	Mother West Wind's Children	Little, Brown & Co.
Burgess	Mother West Wind's Animal Friends	Little, Brown & Co.
Burgess	Mother West Wind's Neighbors	Little, Brown & Co.
McManus and Harren	Natural Method Third Reader	Charles Scribner's Sons

Schwartz	Grasshopper Green's Garden	Little, Brown & Co.
Scudder	Book of Fables and Folk Stories	Houghton Mifflin Co.
Smith	Eskimo Stories	Rand-McNally & Co.
Treadwell and Free	Reading-Literature, First and Second Readers	Row, Peterson & Co.

FIFTH GRADE

Eggleston	Stories of Great Americans for Little Americans	American Book Co.
Lorenzini	Pinocchio	Ginn & Co.
Murray	Story Land	Little, Brown & Co.
Scottenfels	Stories of the Nibelungen for Young People	A. Flanagan & Co.

SIXTH GRADE

Hancock	Children of History	Little, Brown & Co.
Spyri	Heidi	Ginn & Co.
Thorne-Thomsen	Birch and the Star and Other Stories	Row, Peterson & Co.
Thorne-Thomsen	East o' the Sun and West o' the Moon	

SEVENTH GRADE

Greene	Legends of King Arthur and His Court	Ginn & Co.
Maeterlinck	Blue Bird for Children	Silver, Burdett & Co.
Mallory	King Arthur Stories	Houghton Mifflin Co.
Swift	Gulliver's Travels	Harper & Brothers

INDEX

Abell, A. M., 47 f.
Ability to grasp meaning of contents, 66.
Adult reader's photographic record, 263 ff.
Ahrens, A., 6.
Anæsthesia, visual central, 9.
Articulation, atrophy of, 48; vestigial, 107; unnecessary, 115 ff.
Assimilation, 66 ff.
Association, mental, 112 f.

Bain, A., 102.
Baldwin, J., 104 ff.
Ballet, G., 102 ff.
Bastian, H. C., 105.
Bawden, H. H., 106.
Bowden, J., 41.
Brown, W., 203 ff.
Buckingham, B. R., 91.
Bureau of Educational Research, 149.
Bushwell, G. T., 18.

Cattell, J. M., 3.
Chart, class, 75 ff.; growth in speed shown by, 214 ff.
Charters, W. W., 3.
Collins, J., 105.
Comprehension, effect of training in speed, upon, 197 f.
Concentration of attention, 63 ff.
Conference, reading, 160.
Consciousness, pragmatic theory of, 102.
Control, method of, 153: group, 153.
Correlation between rate and comprehension, 14 ff., 19 ff.
Courten, H. C., 106.
Courtis Test, 166.
Curriculum, criterion for, 20 f.
Curtis, H. S., 106.
Curtis, J. N., 60.

Dearborn, W. F., 7, 12, 79.
Decrease of vocalization in silent reading, 43 ff., 100 ff.
Delabarre, E. B., 7.
Directions to pupils, 98 f.
Discrimination reaction time, 224 f.
Dodge, R., 4 ff.
Dynamogenesis, theory of, 110, 113.

Egger, V., 102 ff.
Emphasis, in teaching reading, 22 ff.
Erdmann, B., 4 ff.
Eye-movement, habits of, 54.
Eyes, apparatus to measure movement of, 5 ff.
Eyes, movements of, during reading, 5 ff.; interfixation movements of, 8 ff.; fusion, due to velocity of, 9; return sweep of, 9.

Field of vision, 127.
Fixation-pauses, 10 ff.; number of, 11; duration of, 11 f.
Fordyce, C., 55.

Gary, norms of, 203.
Goldscheider, A., 3.
Graph, individual, 74 f.; how to make, 158 ff.
Gray, C. T., 15, 40, 44 ff., 50 ff., 60 f.
Gray, W. S., 15, 54.

Habits of eye-movement, 54 ff.
Hansen, F. C., 107.
History of reading, as school subject, 28 f.
Holmes, H. W., 1.
Holt, E. B., 9.
Hosic, J. F., 163.
Huey, E. B., 5 ff., 38, 48.

Idea, kinæsthetic, 106.
Imagery, visual type of, 78 f.; audi-

tory, 79; motor, 79; relation to speed of reading, 133 ff.; "surrogate," 138; mixed, 137 ff.; dominant, 136; vocal-motor, 137.
Index of comprehension, 168 ff.; measured by number of questions answered, 210 ff.
Innervation, sensations of, 102.
Interest, immediate, 65; mediate, 76.
Introspection, in reading, 64, 67, 103, 117.

James, W., 85.
Javal, E., 6.
Judd, C. H., 7 ff., 16, 30.

Kraepelin, E., 164.

Lamare, 6.
Lehmann, A., 107.
Lip-movement, 43 ff.; origin of, 108 ff.

Mann, H., 23.
Massachusetts, Board of Education, 23.
Material, suitable for reading, 281 ff.
Meade, C. D., 17.
Messmer, O., 79.
Methods, of teaching reading, 3 f.; alphabetical, 4; word and sentence, 4.
Meumann, E., 137 ff.
Mueller, R. F., 3.
Musculature, articulatory, 103 ff., 134 f.

Netschajeff, A., 136.
Neural factor, 77.
Norms, present compared with proposed, 203.

Oberholtzer, E. E., 17, 41.
O'Brien, J. A., 203, 204 ff.
Ocular reaction, uniformity of, 54 ff.
Ocular span, 56 f.
Overlapping of visual spans, 58.

Paraphrase, 88.
Paulhan, F., 104 ff.
Perception, training in, 49 ff., 126 ff.
Perceptual process, by word-, phrase-, and sentence-wholes, 3.
Perceptual span, relative and absolute, 52, 132 f.; widening of, 50 f.
Peters, C. C., 37.
Phonetics, 22 f., 151.
Photographic records, 234 ff.
Physiological, basis of reading, 14, 70.
Pintner, R., 16 f.
Practice, in rapid reading, 37 ff., 82 ff.; length of, 91 ff.
Prehension, span of, 139.
Premonitions, meaning, 129.
Preparation, thought, 96 ff.; word, 98.
Psychological test, 136 f.
Psychology, findings of, modify reading methods, 3 ff.
Purpose, effect of, in reading, 59 ff.

Quantz, J. O., 36, 43 f., 108 ff.
Questioning, manner of, 94 f.

Rapid reader's photographic record, 253 ff.
Rate, of reading, effect of training on, 171 ff.; comparison with norms, 203 ff.; factors in, 36 ff.
Reaction time, of eye-movements, 77 f.; correlation with reading rate, 224 ff.
Reading, comparison of silent and oral, 13 ff., 16 ff.; rates of, 16 f.; comprehension of, 18 ff.; neglect of silent reading, 20 ff.; anachronism of oral, 25 ff.; silent, emphasis on, 29; alternate, and reproduction, 93 ff.
Recognition of value of rapid reading, 70 f.
Refixation, 14.
Regressive movements — variation in, 61.
Relative gains in speed, in different grades, 198 ff.
Repetitive reading, 53.
Reproductions of matter read, 19, 64.
Rhythm of eye-movements, 54 ff.
Ribot, T., 101 ff.
Rivers, W. H., 164.
Ruediger, W. C., 68 f.

Schmidt, W. A., 5, 11, 12, 14 f.
Secor, W. B., 115.
"Set," mental, 60, 62, 74, 94.
Sex, factor of, 231.
Skimming, 94.
Slow reader's photographic record, 258 ff.
Speech, inner, definition of, 100 f.; history of, 101 ff.; origin of, 108 ff.; necessity of, 114 ff.; means of inhibiting, 117 ff.
Starch, D. A., 203 ff.
St. Louis school survey, 63.
Stoelting, C. H., 142.
Stricker, S., 103 ff.
Stumpf, C., 104.
Subject matter affecting reading rate, 53.
Synaptical connections, 112.
Tachistoscopical exposures, 4, 50 f., 83 f.
Tests, standard, 16 ff.
Thorndike, E. L., 24.
Time, control, 73 f.; amount devoted to reading, 1.
Training in rapid reading, length of, 152 ff.
Tulsa reading survey, 41.

Variability, in amount of gain, 208 f.
Vision, peripheral, 127 ff.; foveal, 130 ff.

Waldo, K. D., 202.
"Warming up" period, 96 f.
Whipple, G. M., 60.
Will to read rapidly, 71 ff.
Work curve, 164, 228 ff.

Printed in the United States of America.

CATHOLIC THEOLOGICAL UNION
BF456.R202 C001
SILENT READING, WITH SPECIAL REFERENCE T
3 0311 00003 9110

WITHDRAWN

19211

BF
456
.R202
AUTHOR
19211
O'Brien, John Anthony
SILENT READING.
TITLE

372.4 23,211 013S

EX LIBRIS PROVINCIAE
PRO STUDIO THEOL.
S.S. CORDIS JESU.

3 03